

ANNALS
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SOUTH AFRICAN MUSEUM
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1. *Monograph of the South African Polyplacophora (Chitons).*—By
EDWIN ASHBY, F.L.S.

(With Plates I–VII and 2 Text-figures.)

In Mr. Ashby's Monograph twenty-four species and three varieties are described, and for the most part figured, from South African waters. As in other papers dealing with the marine fauna, the limits of South Africa are reckoned as extending on both the east and west coasts up to 15° S. lat. In addition, Mr. Ashby re-describes one species from Tristan da Cunha, and describes a new species from Madagascar, as well as giving a list of Madagascan Chitons which may be proved by later collecting to occur also within our limits.

Of the material examined by Mr. Ashby, examples of four species have been contributed by both the Oxford Museum and the United States National Museum; examples of two species each by the British Museum, the Albany Museum, the Natal Museum, and the Transvaal Museum; and examples of eighteen species by the South African Museum.

The South African Museum material was originally placed in the hands of Mr. J. R. le B. Tomlin, together with the whole collection of marine Mollusca, but was transferred to Mr. Ashby for the purpose of this monograph with Mr. Tomlin's concurrence.—EDITOR.

INTRODUCTION.

THE name Chiton (Greek for an armoured tunic or coat of mail) was proposed by Linne (1758) and has been universally adopted as the vernacular name of members of the order Polyplacophora. Iredale and Hull (Austr. Zoologist, iii, 5, pp. 186, 187, 1923) have proposed the substitution of the word Loricates, but as there is no International Rule making such an alteration necessary, its adoption would be most undesirable.*

* It would seem, however, that under the International Rules *Loricata* Schumacher, 1817, should displace *Polyplacophora* Gray, 1821.—EDITOR.

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The Animal.—Chitons are “stomach-footed” as in the Gasteropoda, are furnished with gills or ctenidia on either side, which, according to the family, may extend from only a quarter to the full length of the foot; the head is separated from the foot and is furnished in common with other Gasteropoda with a radula, a flexible tongue or lingual ribbon, which is armed with teeth and is used for rasping food, consisting chiefly of various forms of alga. The animal on the upper side is protected by a sort of “coat of mail,” consisting of eight separate

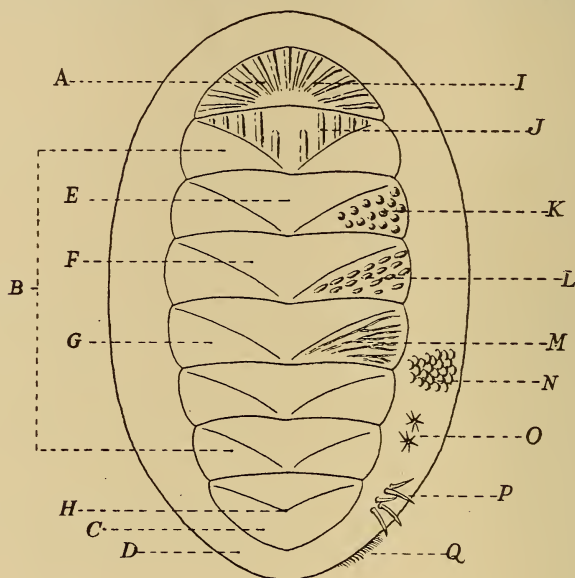


FIG. 1 (Explanations, p. 55).

pieces of shell termed valves, which are held together by a flexible leathery girdle. The shell is bilaterally symmetrical. There are three distinct methods of sculpture in each individual, that of valve 1, termed the head valve or anterior valve, that of valve 8, termed the tail valve or posterior valve, and that of the six intermediate valves, termed median valves, or by some authors central valves. Each valve is composed of two layers, the outer called the “tegmentum” and the inner the “articulamentum”; between these two layers ramify channels for the nerve fibres.

Sculpture of the Tegmentum.—*Head Valve*—this may be smooth, grooved, radially ribbed or granulose (these variations of sculpture are common to all the valves). *Tail Valve*—this is furnished with a raised apex termed the “mucro,” which may be anterior, central,

posterior, or terminal; the posterior portion of this valve is in sculpture more or less the same as the lateral areas of the median valves, the anterior portion similar in varying degrees with that of the dorsal-pleural areas of the six median valves. *Median Valves*—vary in the same specimen considerably as to size and shape, but all six are sculptured on the same pattern. The ridge is termed the “dorsal area” or “jugum”; this often protrudes posteriorly in what is termed the “beak” or “umbo,” is often wedge shaped, sometimes linear, and smooth, grooved, or granulose. There are two pleural areas (either side), forming the anterior portion of the valve and abutting on the dorsal area on one side and the girdle on the other. There are two lateral areas which form the posterior portion of the valve and which in many species is raised; the raised line dividing this area from the pleural is often termed the diagonal.

Inside or Articulamentum.—Except in the most primitive genera the articulamentum is extended beyond the tegmentum in what is termed “the insertion plate.” This plate may be entire or divided into a number of “teeth,” the teeth may be smooth-edged, serrate, or laminate. (The insertion plate is a survival factor, developed to increase the strength of the attachment of the protecting shell to the body.) The tegmentum also extends forward somewhat, leaving a wedge-shaped gap between it and the insertion plate; this is termed the “eaves.” There is a forward development of the articulamentum at the “sutures,” under the valve immediately in front, which forms the hinge, and is usually in two pieces termed the “sutural laminae”; the gap between is called the “jugal sinus.”

The Girdle.—The girdle varies greatly in different genera; in some it is narrow, in others capable of great extension; the girdle clothing, armature, or ornamentation (all terms used) may consist of imbricate scales, erect scales, spicules (termed also setae), bristles or hairs. In most cases the scales and spicules are superficially or epidermally attached, in which case they are by themselves only of specific value, but others also possess peculiar setae (which have been termed “deep-seated”) which seem deserving of generic valuation; thus, for example, members of the subfamily Acanthochitoninae extrude bunches of spicules through pores placed at the sutures of the valves.

Nervous System.—As has been before stated, numberless nerve-channels ramify between the tegmentum and articulamentum, connecting with the body through pores in the articulamentum and through the “eaves” with the girdle, and also through numberless minute perforations in the tegmentum termed “megalopores” (the

smaller of these sometimes called "micropores"); also, in some genera, sense-organs termed "eyes" are present in portions of the tegmentum, and function, it is believed, analogously with that organ.

Ecology.—The greater number of genera are littoral in habit, their station varying from half-tide to well below lowest tide mark; they may be on exposed rocks upon which the surf breaks or under stones in sheltered pools. The larger number of species shelter on the bottom rock of a pile of stones situated just below lowest tide mark.

Hard rock with fairly smooth faces are preferred to rough or gritty rocks, thus sandstone or limestone, unless of unusual hardness, are unfavourable to Chitons; some forms prefer to settle on sea-shells, and one genus lives on "sea grasses."

CLASSIFICATION.

Ashby's Short Key in "Taxonomic Value of Characters in the Order Polyplacophora" has received the endorsement of the leading workers in the order Polyplacophora in America, Britain, Sweden, Germany, and New Zealand. It is as follows:—

"*Short Key*" definitions of those characters in Chitons, one or more of which must be present in every generic description (if only one is present it should be adequately supported by what are termed hereunder "Minor or collateral evidence").

1. Changes in the character of the girdle attachment, such as the presence, absence, or modifications in the insertion plate or other development of the articulamentum.*

2. Modifications in the dentition of the radula.

3. The position and form of the gills (ctenidia); modifications of the body organs, which are often indicated by the structure of the shell.

4. Modifications of the sense organs.

4a. Existence of or modifications in sense organs in the valves.

4b. Major modifications of the girdle armature.

In this Monograph I have adopted the partial revision proposed by the writer in various published papers. Pilsbry (Man. Conch., xiv,

* Ashby in "Acanthoid Chitons of New Zealand" (Proc. Mal. Soc. Lond., xvii, p. 9, 1926) says: "The hypothesis that the modifications in the insertion plates of *Polyplacophora* are due to the influence of ecological conditions over vast periods of time, and that these characters give us the best guide to the species' proper place in the Natural Taxis, is increasingly substantiated the more I study this group of Mollusca. One is therefore the more willing to place confidence in those divisions that are based on such features."

p. xxiii, 1892) states : " It is commonly known that the Palaeozoic Chitons are, without exception, destitute of insertion plates, and belong therefore to the family Lepidopleuridae." In 1900 Pilsbry, in Zittle, proposed the suborder Eoplacophora for the reception of these Palaeozoic forms, pointing out that the link connecting these with the most primitive group of living Chitons had not yet been discovered. The discovery in the Balcombian beds in the Tertiary deposits in the State of Victoria (Australia) of the end and median valves of *Protochiton granulosus* Ashby & Torr, obviously supplies a missing link between the Palaeozoic and one group of living forms. *Protochiton*, although without insertion plates, is undoubtedly related to the living Acanthoid group of Chitons, and on the other hand the tail valve of *Chiton gemmatus* de Koninck, from the Carboniferous beds of Dunfermline, Scotland, is in the peculiar character of the outward extension of the tegmentum, absence of insertion plate, and general shape almost its prototype, the only material difference being that in *Protochiton* the sutural laminae are widened and extended somewhat down the side of the valve ; there is no known living species that has these characters.

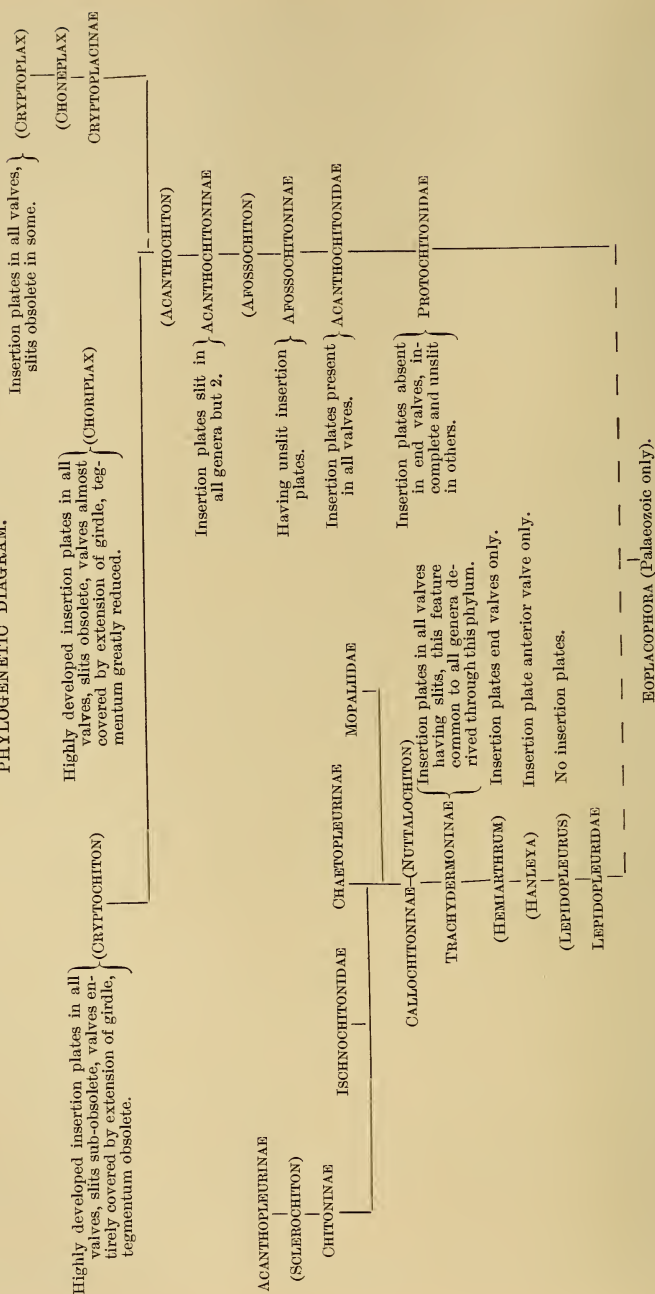
It is also quite evident that *Protochiton* is unrelated to any member of the Lepidopleuridae. This necessitates a partial revision of our previous conception of the classification of Chitons.

We must now conclude that living forms came down from Palaeozoic stock along two or more separate groups or races, developing along parallel lines, as in the diagram on following page. Dr. Thiele's discovery that, assembled under the family Lepidopleuridae, there are several species with dissimilar radula, although the absence of insertion plates is common to all, undoubtedly supports this conception.

I wish to express my thanks to all who have assisted me in the preparation of this work by the loan of material, and make special mention of the following : The Trustees and the Keeper of the Conchological Collections of the British Museum, Mr. G. C. Robson, M.A.; the Trustees and the Curator Dr. Paul Bartsch, Curator of the Division of Marine Invertebrates, United States National Museum, Washington ; the Trustees of the Oxford Museum, England ; the Director and Dr. K. H. Barnard of the South African Museum ; Mr. John Hewitt, Director of the Albany Museum ; Dr. E. Warren, Director of the Natal Museum ; the Director of the Transvaal Museum.

A check list is supplied at the end of this paper giving added information in respect to classification.

PHYLOGENETIC DIAGRAM.



NEED FOR SPECIALISED WORK IN SOUTH AFRICAN CHITONS.

E. A. Smith stated in 1903 "That until the year 1848, when Dr. F. Krauss published his work on 'The Mollusca of South Africa,' the fauna of that region had not received special attention." In 1874 Dr. E. von Martens listed a collection made by Dr. G. Fritsch. In 1892 G. B. Sowerby published a Catalogue of "Marine Shells of South Africa." E. A. Smith published an Appendix thereto in 1903. Sykes, in 1894, published a short paper on "South African Polyplacophora." Dr. Paul Bartsch published a description of Chitons in the "Turton Collection," 1915; and Ashby, in 1928, described additional material collected by Col. Turton at Port Alfred, South Africa. As regards the Polyplacophora, the papers referred to above were useful but fragmentary.*

SUBORDER PROTOCHITONINA.

Family ACANTHOCHITONIDAE.

Subfamily ACANTHOCHITONINAE.

Acanthochiton garnoti (Blainville).

(Pl. I, figs. 1-4.)

Chiton garnoti, Blainville, Dict. Sci. Nat., xxxvi, p. 552, 1825; Quoy and Gaimard, Voy. de l'Astrol. Zool., iii, p. 401, pl. lxxiii, figs. 9-14; Krauss, Die Südafrik. Moll., p. 42. *Chiton danielli*, Sowerby, Conch. Illust., p. 7, fig. 45. *Acanthochites garnoti*, Pilsbry, Man. Conch., xv, p. 14, 1892; Thiele, Rev. Syst. Chit., p. 44, 1909. *Acanthochiton garnoti*, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 78, 1928.

A large series of this shell is before me from False Bay, Table Bay, Port Elizabeth, Port Alfred, and Kasouga (Bathurst District). The variability in the sculpture is very great, not only in different examples but also in the median valves of the same specimen. This shell seems particularly subject to erosion. The dorsal area, when present, is longitudinally grooved; in many examples the sculpture abutting on this area consists of very elongate flat granules, which are replaced towards the girdle with circular, raised granules, whereas in other examples only the circular form of granule is present, in some they are convex, in others almost flat. These variations do not justify specific separation unless they represent geographical races,

* The author omits the important paper of Nierstrasz, Zool. Jahrb., xxiii, 1906.

which I do not think is the case. This species is very near the Australian species known as *A. bednalli* Pilsbry, but is more robust, more coarsely spiculose, and more variable in the character of its sculpture. The example measured is 25×15 mm., the anterior valve has 5 slits; median valves and tail valve, slits 1/1. Angle of divergence, 105° .

The following description is copied from Pilsbry (*loc. cit.*) and needs no addition beyond the foregoing notes.

Description.—"Shell elongated, rather depressed, not carinated. Brownish with two slightly diverging whitish stripes bounding the dorsal area. The median valves are rather beaked when not eroded. The tegmentum varies on different valves from subpentagonal to subquadrangular. Latero-pleural areas closely and evenly covered with elongate granules. Dorsal areas triangular, rather wide in front, not sharply defined at the sides, closely striated longitudinally, the striae coarser at the sides and becoming transformed into granulation of the side areas. Posterior valve small, the tegmentum broader than long. Posterior sinus shallow, with a slight lobe and on each side a slit. Mucro behind the middle. Interior a rather dark blue green, the cavity and the central callus of each valve purple brown. Sinus wide and rounded; sutural laminae very large, well rounded at their anterior extremities, about equal in area to the tegmentum, side slits inconspicuous, posterior. Girdle dirty green, closely covered with clear or dark green bristles, white at the periphery, and having eighteen bunches of numerous, radiating bristles, which are dirty green, hyaline, very brittle, and over 2 mm. in length."

Acanthochiton turtoni Ashby.

(Pl. I, fig. 5; Pl. II, figs. 6-8.)

A. turtoni, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 79, pl. vi, figs. 1-4, 1928.

General Appearance.—Elongate, carinate, beaked; dorsal area longitudinally grooved, latero-pleural areas decorated with widely spaced, squamose granules; hair tufts very marked; spicules long, glassy, and slender, those of girdle-fringe being similar, the rest of girdle clothed with shorter spicules. Colour of holotype "La France Pink" (Ridgway, pl. i), though slightly darker and duller; girdle brown.

Head Valve.—Elevated, having 5 ray-folds or shallow ribs, whole surface decorated with narrowly spaced, flat, ovate granules, the

arrangement is irregular, but somewhat concentric ; these grains are small at the apex of valve and increase in size rapidly towards the girdle.

Median Valve.—Elevated, strongly beaked, side slope straight ; dorsal area broadly wedge shaped, deeply longitudinally grooved, ribs minutely granulose towards beak ; latero-pleural area decorated by sinuate, longitudinal rows of flat, ovate granules, the grains are narrowly separated in the rows, but the space between the rows is a little broader ; as the granules correspond fairly well with those in the preceding row, a partial system of transverse sculpture is present, the grains commence small at the beak and increase in size outwardly and also along the margin of dorsal area ; there is a distinct diagonal fold corresponding with the slit.

Tail Valve.—Elevated, medium size, mucro well defined at the posterior third, slope behind the mucro steep, in some examples slightly concave ; dorsal area defined similar to median valves, balance of anterior sculpture similar to pleural area ; portion behind the mucro—granules more circular, convex, and crowded than is the case in lateral areas, with a tendency in some examples to produce extra large grains bordering the girdle.

Inside (articulamentum).—Translucent white, polished and pearly, with in places the pink tegmentum showing through ; insertion plate, upper side brown. Head valve, slits 5 ; tail and median valves, slits 1/1. Sutural laminae medium in size, sinus wide.

Girdle.—Hair tufts very marked, spicules long, glassy, and slender, furnished with a girdle-fringe of the same character, the rest of the girdle densely clothed with shorter spicules, often broken and filled in with minute sand grains.

Measurements.—The largest dry, 15×7 mm. The holotype head valve, 2.75×2 mm. ; median valve, 3.2×2.5 mm. ; tail valve, 2.9×1.5 mm. Angle of divergence, 105° .

Comparisons.—The shell of *A. garnoti* is low and arched, whereas in *A. turtoni* it is rather strongly raised and subcarinated ; the grains in *A. garnoti* are more closely packed, and the shape of the tail valve is markedly different ; the girdle in *A. turtoni*, as compared with *garnoti*, is narrow, and the spicules other than the hair tufts inconspicuous.

Habitat.—Those referred to in the type description and two sent from the Oxford Museum, No. 1050, are all from Port Alfred and were collected by Col. Turton ; the largest is in the Oxford Museum Collection ; in it the girdle-fringe is more spiculose than in any of the others.

Acanthochiton turtoni var. *tenuigranulosus* nov.

(Pl. II, fig. 13.)

One example from the Oxford Museum (No. 1051) and one median valve (No. 1052). The former is dry and curled, and also came from Port Alfred, and in the shape of the valves and in the sculpture of the dorsal areas is similar to *A. turtoni*, but in the sculpture of the latero-pleural area is distinct; the granules here are much more closely packed, although the spaces between the rows are wider and the grains themselves are narrower and less raised; the colour is chestnut brown. With the limited material before me I do not feel justified in giving to this undoubtedly nearly allied form a specific name, but prefer for the present to distinguish it as a variety only.

Notoplax productus (Pilsbry).

(Pl. I, figs. 9-12.)

Spongiochiton productus, Pilsbry, Man. Conch., xiv, p. 26, 1892; *Acanthochites (Loboplax) carpenteri*, Pilsbry, Man. Conch., xv, p. 35, 1893; *Onithochiton? isipingoensis*, Sykes, Proc. Mal. Soc. Lond., iv, p. 259, text-figs., 1901; *Acanthochiton variegatus*, Nierstrasz, Zool. Jahrb. Syst., xxiii, p. 487, 1906. Iredale considers *S. productus* and *A. carpenteri* conspecific, Proc. Mal. Soc. Lond., ix, p. 100, 1910. *Spongiochiton productus*, Thiele, Rev. Syst. Chitonon, p. 36, pl. v, figs. 4-7, 1909; *A. variegatus* and *Notoplax carpenteri*, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, 1928.

There are two examples in the material before me, one the property of the Transvaal Museum (No. 759) and labelled *Acanthochiton variegatus* Nierstrasz, and the other the property of U.S. Nat. Museum (No. 250605), labelled *Acanthochites carpenteri* Pilsbry.

Both specimens are, in my opinion, the same species, although the "hair tufts" are not visible in No. 759, but are clearly seen in No. 250605. I have disarticulated the example from the Transvaal Museum, and the following is its description.

General Appearance.—Girdle about double the width in front that it is behind, shell not carinated but flatly arched, dorsal area broadly wedge shaped, much worn but many cuneiform gashes in places; sculpture of rest of valves coarse pebble-like grains, girdle felty, no hair tufts showing, yellowish white, the shell is pink merging into pale buff.

Head Valve.—Flat, tegmentum very reduced as compared with the

articulamentum, radial ribs not perceivable, but in the other example they are suggested in the enlargement of the pebble-like grains ; sculpture composed of large, irregular to lozenge shape, highly raised, pebble-like, convex grains, most of which are anteriorly elongate and some pointed, colour pink merging to pale buff.

Median Valve.—The shape of this valve varies greatly. In valve 2 the tegmentum is longitudinally the same as in the other valves but laterally much compressed, and the sutural laminae are in this valve produced forward and not outwards. The following is the description of valve 5 : valve flat, dorsal area well defined, slightly depressed on either side, forming a shallow trough separating the low ridge from the pleural area, the only sculpture of this area are irregular, cuneiform pits or gashes ; pleural area beset with large, pebble-like grains, most elliptical and convex, the lateral area is ill defined but slightly raised and the grains are twice as long as they are in the pleural area. Valve 6 has the trough of the dorsal area highly developed, and it was probably this feature that Sykes intended to depict in his figure of *O. isipingoensis*.

Tail Valve.—Mucro defined, appears posterior if viewed from above, but if horizontally median, the slope behind almost vertical ; dorsal area defined, broadly wedge shaped, smooth except for a few pits ; pleural area similar to other valves except some grains are longitudinally confluent with corresponding groove each side ; area behind mucro, grains narrow and elongate, placed radially.

Inside (articulamentum).—Head valve—interior white, insertion plate broader than tegmentum, slits 5, well defined, and grooves carried to the tegmentum ; teeth sharp, smooth, except for few scratches, without eaves. Median valve—slits 1/1, sutural laminae extended laterally (except in valve 2), jugal sinus broad, colour pink at beak, fading to white. Tail valve—sutural laminae extending laterally, shallow anteriorly ; jugal sinus broad ; slits 4, grooved to the tegmentum ; insertion plate almost vertical, 2 mm. broad.

Girdle.—Very broad, when dry and curled 5 mm. wide, felty, encroaches at the sutures, hair tufts are in this example obsolete or sub-obsolete, present in other example where the spicules are short and stout, mostly broken off short. This example also possesses a girdle-fringe of similar spicules much broken ; the girdle is clothed with minute arenaceous scales.

Measurements.—Example dry and much curled, width over all 14 mm. Following curvature of animal ; tegmentum 8.5 mm. in width, and girdle 5 mm. either side—that is, the girdle occupies

10 mm. of total width and the tegmentum 8.5 mm. Angle of divergence about 130° .

Habitat.—Transvaal Museum (No. 759) is labelled Jeffrey's Bay, St. Francis Bay; the U.S.N. Museum (No. 250605) is from Port Alfred, and was collected by Lieut.-Col. Turton. The example figured by Pilsbry as *carpenteri* came from Port Elizabeth; Sykes' example came from Isipingo.

In conclusion.—The name *Spongiochiton* was proposed in MS. only by Carpenter, listed by Dall in 1873, and published with Carpenter's MS. definition by Pilsbry in 1892 under the ISCHNOCHITONINAE. In 1893 Pilsbry published a figure under the name *Acanthochites carpenteri*, pointing out that it belonged to Dall's subgenus *Macandrellus*, a name that Ashby has shown must be replaced by *Loboplax* Pilsbry. These genera cannot seemingly be valued higher than subgenera, and in face of the very limited material I prefer to attach the generic name *Notoplax* only. I would point out that *N. productus* has characters in common with some New Zealand Chitons for which I proposed the subgeneric name *Amblyplax*, and some allied forms have by some writers been placed with doubtful justification under the genus *Craspedochiton*. If on further study these groups are found to be con-subgeneric, the name *Spongiochiton* would antedate the others.

Subfamily CRYPTOPLACINAE Thiele.

Cryptoplax sykesi Thiele.

Cryptoplax sykesi, Thiele, Rev. Syst. Chitonen, i, p. 53, pl. vi, figs. 83–86, 1909; *C. striatus*, Sykes (non Lamarek), Journ. Mal., vii, p. 164, figs. 2–5.

Sykes figures 8 valves touching one another. Thiele only figured

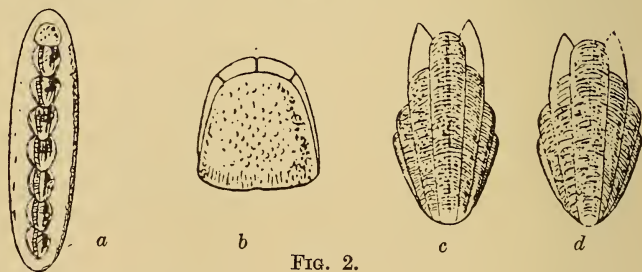


FIG. 2.

the tail valve. Locality: Natal. I have seen no example. The following is Sykes' description:

"The girdle shows no signs of pores, but is densely clothed with small spicules, forming bunches at the sutures.

"The valves, partly covered by the girdle, are all in contact and have no intervening area. The head valve is granulose, while the other valves have an almost smooth central area, and the lateral and median areas are sculptured with bold, slightly granulose ridges, this sculpture becoming more obsolete and the ridges breaking into granules as we proceed from the tail to the head valve. On comparing this species with young specimens of *C. striatus* Lamk. I have been unable to find specific characters sufficient to justify the description of it as distinct."

Habitat.—Umkomaas, in Natal; collected by Mr. Burnup, a single specimen. Measured about 14 mm. curled and dry.

Cryptoplax dupuisi n. sp.

(Pl. II, figs. 14, 15.)

Introduction.—In the collection of exotic Chitons given to the writer by Major Paul Dupuis, now Conchologist of the Musée Royal d'Histoire Naturelle de Belgique, are two examples of a *Cryptoplax* from Madagascar. These differ from *C. burrowi* Smith, and from Sykes' figures and description of *C. sykesi* Thiele. While Madagascar proper is outside the range of this paper, this species may well occur in Natal, and although seemingly so distinct from *C. sykesi*, may possibly be the senile form of that shell.

Holotype in Ashby collection; paratype in collection of South African Museum.

General Appearance.—In dried example valves 1, 2, and 3 imbricate, space between 3 and 4 is 1.5 mm.; between 4 and 5, 7 mm.; between 5 and 6, 10.5 mm.; between 6 and 7, 14 mm.; between 7 and 8, 4 mm. The first four valves are horn colour, with some wide, pale ray markings on head valve, the girdle densely covered by adpressed, flat, translucent spicules; colour buffy brown (Ridgway, pl. xl).

Head Valve.—Raised, smooth except for 4 deep, concentric growth grooves.

Median Valves.—Valve 2—almost circular, carinated; dorsal area smooth, narrow, beaked; a little irregular granulose ridging next dorsal ridge, rest of valve smooth except for deep, irregular, concentric growth grooves. Valve 3—dorsal area similar to valve 2, rest of valve decorated with widely spaced, jagged, longitudinal grooves.

Valve 4—dorsal area sub-obsolete in anterior half, rest of valve as in valve 3. Valves 5 and 6—similar to valve 4. Valve 7—keeled, raised, dorsal area narrow, smooth, and beaked, each side possesses 5 irregular, jagged, longitudinal grooves.

Tail Valve.—Shuttle shape, strongly elevated and carinated, dorsal ridge very narrow and broken posteriorly, each side 7 deep, longitudinal, wavy grooves; mucro posterior.

Girdle.—Buffy brown, the anterior portion as far as valve 4 blackish brown; densely clothed with adpressed, flat, translucent spicules, a feature it has in common with *C. michelseni* Thiele, of which *C. hartmeyeri* is a synonym, very distinct from *C. striatus* Lamk. and most other species.

Measurements.—The whole animal curled and dry is 47×14 mm. Example not disarticulated, exposed portions of valves only given. Head valve, 5×5 mm.; valve 4, 4×1.5 mm.; valves 5 and 6, 2.5×1.5 mm.; valve 7, 6×3.5 mm.; tail valve (example No. 2), 6×3 mm.; elevation of tegmentum, 2.5 mm.

Habitat.—Madagascar.

Comparisons.—Differs from *C. sykesi* in that the sculpture is not regular as shown in his figure; also the dorsal area is narrow not broadly wedge shaped, as shown in Sykes' figure of *C. sykesi*; differs from *C. burrowi* in not having granulated sculpture in the head valve and in possessing a much larger, strongly raised tail valve, and differs from *C. michelseni* (syn. *hartmeyeri*) in the absence of the granulated sculpture of the head valve and in the absence of the small spicules which in Thiele's shell separate the larger, flat, adpressed spicules from one another.

Note.—It must be remembered that in most, if not all, the members of this genus the juvenile form is very diverse from the adult (leading in some cases to the description of the juvenile as a different species). Thus, in the juvenile all the valves are imbricate, however far they are separated in the adult or senile form; the valves in the very juvenile are broad in proportion to length, and in this stage simulate those of an *Acanthochiton*; in the next stage the valves increase longitudinally and not laterally, then appearing long and narrow; in most, if not all, species up to this stage the sculpture is granulose, but in many species the method of sculpture abruptly changes from granulose to that of coarse longitudinal ribs or ridges, at which stage the additions to the shell almost cease and the growth of the body and girdle in time separate, some, usually the last four valves, sometimes quite widely. It seems hardly likely that *C. sykesi*, which

measured 14 mm. in length when dry, could be the juvenile form of the one above described under the name *C. dupuisi*, but this possibility, although seemingly remote, must be kept in view when new material is available.

SUBORDER LEPIDOPLEURINA.

Family LEPIDOPLEURIDAE.

Lepidopleurus sykesi (Sowerby).

(Pl. II, figs. 16-19.)

Chiton (*Hanleya*) *sykesi*, Sowerby, Mar. Invest. S. Africa, ii, p. 225, pl. v, fig. 13, 1903.

General Appearance.—Colour, pale straw colour except where valve is overlapped by valve in front, this portion is white; shell much raised, arched not keeled, sculpture consists of closely packed, minute grains arranged in longitudinal rows in dorsal-pleural area, partly radial in lateral area, some deep, concentric growth grooves present in most valves; girdle narrow, clothed with short, glassy spicules.

Head Valve.—Laterally wide, raised, decorated (under 20 mag.) with closely packed, radiating rows of minute grains; (under 65 mag.) these grains are seen to be circular, convex, and mostly separated; there is no sign of coalescing; towards the outer margin there are several deep, concentric growth grooves.

Median Valve.—Shell highly raised, arched, dorsal-pleural area inseparable, decorated with longitudinal rows of minute, flattened granules a little larger than those in anterior valve; those on the jugum are smaller and show a tendency to coalesce, but the grains increase in size towards the girdle. The lateral areas are raised, sculpture only very slightly radial, granules towards girdle slightly larger than pleural area, several concentric growth grooves are present of which the outer three are very deep; valve 4 is used in this description, the side slope is steep and convex.

Tail Valve.—Large and laterally wide, raised, mucro well defined, median slope immediately behind mucro steep, almost vertical, then extending outwards in a straight slope; in front of mucro sculpture similar to that of pleural area in median valves; mucro itself and immediately behind smooth, posterior portion similar to head valve but without any distinct radial arrangement, several deep, concentric, growth grooves are present.

Inside (articulamentum).—White, all valves without insertion plates; but the head valve possesses a very interesting feature in that, commencing at the suture and continuing on either side for about 1 mm., the articulamentum has extended forward, these two small, shallow, protruding plates, equal to about two-sevenths of the periphery, are evidently the beginnings of what will ultimately develop into an insertion plate; sutural laminae weak, produced forward; tegmentum slightly bowed outwards in the jugal sinus, which is very broad; a callus joins the bases of the laminae.

Girdle.—Narrow, densely clothed with white spicules, of these the most numerous are short and stout, $64\ \mu$ in length, fringe spicules $137\ \mu$ long, and some very slender spicules $162\ \mu$ long, some longer.

Measurements.—The whole shell too curled to measure; head valve, 6×3 mm.; valve 4, 7×3.5 mm.; tail valve, 6×4 mm.; angle of divergence, 90° .

Habitat.—The localities of the specimens in the South African Museum are as follows: Cape Point E. 26 miles, 210 fathoms. Type. Lion's Head S. 82° E. 27 miles, 125 fathoms, and N. 67° E. 25 miles, 131 fathoms. Vasco da Gama Peak S. 75° E. 13 miles, 166 fathoms, and N. 71° E. 18 miles, 230 fathoms. South Head E. \times S. $\frac{1}{2}$ S. 25 miles, 190 fathoms. (All localities are off the Cape Peninsula.)

Conclusion.—In the absence of insertion plate in any of the valves this cannot be placed in the genus *Hanleya*, but it may be considered an advanced member of the genus *Lepidopleurus*. The genus *Hanleya* possesses an insertion plate in the head valve only, whereas the genus *Lepidopleurus* is without insertion plate in all valves.

SUBORDER CHITONINA Thiele.

Family CALLOCHITONIDAE Thiele.

Subfamily TRACHYDERMONINAE Thiele.

Trachydermon (*Craspedochilus*) *turtoni* Ashby.

(Pl. II, figs. 20–23.)

T. (C.) turtoni, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 80, pl. vi, figs. 5–8, 1928.

General Appearance.—Broad, bluntly carinated, side slope a little curved, beaked, ground colour ivory white blotched with brown. The dorsal ridge in valves 2–7 is “sayal brown” (Ridgway, pl. xxix), a white spot on the anterior portion of the dorsal area of valves

2-4. The head valve is freely blotched with a darker shade of brown, and similar, though mostly paler, spots are scattered widely over the rest of shell. The girdle is creamy white, irregularly banded with pale brown.

Head Valve.—Broad, elevation medium, under pocket lens apparently smooth, but under 65 mag. is seen to be minutely radially striate, the striae being close together and the ridges between being barely $12\ \mu$ in width where measured near the girdle. Under a lens of 20 mag. these radial striae are only just visible; while there are no defined radial ribs other than these minute ones, there is evidence of broad, very shallow, ill-defined radial undulations, the presence of which should be more apparent in a larger example.

Median Valve.—Laterally broad, longitudinally narrow, elevated, carinated, side slope convex; dorsal area defined, bluntly beaked, and the whole area under 65 mag. decorated with longitudinal striae, which are more widely spaced than is the case with the ornamentation in other parts of the shell, and are crossed transversely by numerous growth striae, giving to these minute, longitudinal ridges a granulose appearance. The pleural area under the same magnification is seen to be minutely granulose, due to the continuation of the closely packed, transverse growth lines across faint longitudinal ridging. The lateral area is slightly raised, with similar sculpture to the pleural except that here the direction of the minute ribbing is radial.

Tail Valve.—Dorsal and pleural areas indistinguishable, minute sculpture similar to other valves except that the longitudinal grooving is less defined but the transverse striae are stronger; mucro well defined, anterior of centre, slope immediately behind is at first steep, then becoming flatter, the minute sculpture on this part of valve is radial, crossed towards the outer edge by growth lines.

Inside (articulamentum).—White, teeth sharp; slits in head valve probably 10; median valve, 1/1; tail valve, 7; eaves spongy and in median valves much thickened at slit, the perforations in the spongy eaves are very large near the insertion plate but smaller towards the tegmentum; in the tail valve the perforations measure $20\ \mu$ to $25\ \mu$; sutural laminae well defined and jugal sinus very broad.

Girdle.—The girdle is damaged, is creamy white irregularly banded with pale brown, sprinkled over the brownish portions are a number of minute black "grains" that give a greyish tone to the brown. The girdle is densely covered with irregular, arenaceous scales, very similar, though smaller, to the girdle scales of *T. (C.) cinereus* L.; there

is a well-defined girdle-fringe composed of long, very slender, glassy spicules.

Measurements.—The whole shell dry, except tail valve, which was detached, 5×3.5 mm., but as girdle was curled have quoted 5×4 mm.; head valve, 2.5×1 mm.; median valve, 3.3×1.5 mm.; tail valve, 2.25×1.25 mm.; girdle spicules (three measured), 162μ , 175μ , 225μ respectively in length, in thickness tapering from 25μ to 12μ . Scales so irregular that it is difficult to determine their diameter; it is about 12μ . Quite a large number of these have what looks like a pigmented nucleus; this dark spot is a distinct circular pit, with a shining, black substance at the base, the pits are about 3μ in diameter and may be terminals of nerve fibres, and correspond with the micropores of the tegmentum, but its occurrence in minute girdle scales is, I believe, quite a new discovery. Angle of divergence, 90° .

Habitat.—Port Alfred, South Africa. Body, with radula, had been removed.

Note.—The suggestion made by Iredale in 1914, that *Lepidochiton* should replace *Craspedochilus* Sars., I have not adopted, as it requires additional investigation.

Subfamily CALLOCHITONINAE Thiele.

Genus *Callochiton* Gray.

Subgenus *Trachyradsia* Dall., syn. *Stereochiton* Dall.,
syn. *Eudoxoplax* Iredale & May.

Callochiton (*Trachyradsia*) *castaneus* (Wood).

(Pl. II, fig. 24; Pl. III, figs. 25–27.)

Chiton castaneus, Wood, Gen. Conch., p. 13, pl. ii, figs. 2–3; pl. iii, figs. 2–3, 1815; Sowerby, Conch., iii, fig. 114; Reeve, Conch. Icon., pl. v, fig. 25. *C. cerasinus* Chemn., Reeve, Conch. Icon., fig. 63; *C. bicolor* Spengler, 1797, non Gmelin, 1791; ? *C. fulgetrum*, Reeve, loc. cit., pl. xiii, fig. 71, 1847; ? *C. dentatus*, Spengler, Skriv. Nat. Sels., v, 4, p. 88, 1797 (if *C. dentatus* Spengler, 1797, is *C. castaneus* Wood, it would antedate Wood's name); *C. planatus* Spengler, loc. cit., p. 91; *C. fulgetrum* Reeve is considered by Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 32, 1894, as conspecific with *C. castaneus* Wood; *Callochiton* (*Stereochiton*) *castaneus*, Pilsbry, Man. Conch., xiv, p. 52; *C. (T.) castaneus*, Thiele, loc. cit., p. 108; *Eudoxochiton castaneus*,

Ashby, *loc. cit.*, p. 89; *Callochiton* (*Trachyradsia*) *castaneus*, Ashby and Cotton, Trans. Roy. Soc. S. Austr., 1930, not *C. castaneus* Quoy and Gaimard, nor *C. castaneus* Couth.

Note.—Older references extracted from Pilsbry, Man. Conch.

General Appearance.—Two from Table Bay, S.A. Mus., No. 4872, colour burnt sienna (Ridgway, pl. ii), with, in the smaller example (12×7.5 mm. dry) towards the girdle on each valve, a pale yellow blotch; two S.A. Mus., Nos. 4875, 4881, the larger (41×27 mm. curled and dry), beautifully mottled and streaked with yellow, pinkish buff, and chocolate; two specimens from Port Alfred, U.S. Nat. Mus., labelled *Ischnochiton Crawfordi*, No. 249828, one liver colour and bright pink inside, the other liver colour in end valves only. Shell broad, flat, and carinated, sculpture minutely decussate; girdle clothed with shuttle-shaped or broadly needle-shaped scales, which are often detached.

Head Valve.—Flat, laterally very broad, anteriorly very short, decorated under 20 mag. evenly with minute decussate pattern, under 65 mag. is seen the minute, parallel scratching common to members of this genus, and also "eye-dots" easily seen under this power in all valves.

Median Valve.—Flat, carinated, laterally broad, anteriorly short, side slope low and straight, sculpture similar to the anterior valve, lateral area slightly raised, eye-dots numerous in this area situated in defined pits, the eyes are 25μ in diameter.

Tail Valve.—Wide, flat, carinated, mucro slightly anterior of median, sculpture similar to other valves, posterior slope slightly convex.

Girdle.—Wide and capable of great expansion, densely clothed with "needle-like" scales, which in their exposed parts measure $112 \times 25 \mu$. Thiele (*loc. cit.*), p. 106, quotes Nierstrasz (Zool. Jahrb. Syst., v, p. 23), that the needles of *C. castaneus* Wood have an entirely different shape from those of typical *Callochitons*. I disagree with this statement; both the girdle scales and the radula of this species are quite typical of the genus *Callochiton*.

Inside (articulamentum).—Colour, white shading to pink at apex and towards margin of valves, in some nearly all pink. Head valve—insertion plate well produced, slits 22, teeth very irregular, with irregular, rounded edge, partially propped; eaves spongy, overhanging but little. Median valve—slits $4/4$, teeth and eaves similar to head valve; sutural laminae shallow but extended laterally and joined across the middle line, jugal sinus a mere indentation in the

articulamentum. Tail valve—slits 18, insertion plate and sutural laminae similar to other valves.

Measurements.—Head valve, 8×3 mm.; median valve, 9.5×4.5 mm.; tail valve, 7.5×4.5 mm. Angle of divergence, 125° .

Note.—Ashby, without seeing a specimen, listed this species as a *Eudoxochiton* in his paper describing the Turton Collection, because of its similarity in published figures with the Australian *Eudoxoplax inornatus* Ten. Woods; and because May considered *Eudoxoplax* a subgenus of *Eudoxochiton*. Having since examined a juvenile *E. inornatus*, he found it a true *Callochiton*, and Ashby and Cotton have placed it in the section *Trachyradsia*.

Family MOPALIIDAE Pilsbry.

Plaxiphora simplex Haddon.

(Pl. III, figs. 28–31.)

P. simplex, Haddon, Challenger Expd., Polyplacophora, xv, p. 33, pl. iii, figs. 13 a–c, 1886; Pilsbry, Man. Conch., xiv, p. 320, pl. lxvii, figs. 43–46, 1892.

Introduction.—Dr. Barnard of the South African Museum has forwarded to me two examples of a *Plaxiphora* from Tristan da Cunha, with the request that I would include a description in this paper; although the locality is extra-limital I am glad to comply with the request. These two examples are too eroded to allow of a full description; I therefore transcribe Haddon's type description, adding notes on the two examples now before me.

Haddon's Description (Haddon also includes Carpenter's MS. description, but furnishes a better one of his own):—

"Shell smooth, simply marked with lines of growth, flat sides meeting at a variable angle. *Anterior valve*—small, surface smooth. Under surface with 8 slits, teeth fairly long, smooth, and sharp; eaves short. *Intermediate valve*—central area smooth, flat. Lateral areas inconspicuous, with two or three very faint radiating ridges. Under surface with a median horizontal rib-like swelling, sutural laminae broad but not deep; jugal sinus wide and shallow; one lateral slit; eaves short. *Posterior valve*—very small and flat, greatly corroded; umbo apparently flat and terminal; posterior border thickened. Under surface—sutural laminae as in intermediate valves, but the jugal sinus is comparatively narrow and deep; slits and teeth absent; posterior border much swollen. *Girdle*—very

thick and fleshy, upper surface having a spongy appearance owing to being beset with very short, horny spines, which are scarcely raised above the surface; there are tufts of longer spines, three to nine in each tuft, opposite the sutures of the valves; these have no definite position round the anterior valve. Situated outside these are numerous scattered similar tufts, usually somewhat smaller in size, which pass into an imperfect peripheral fringe of spines."

In the two examples before me the tegmentum has been eroded, except the narrow strip protected by the overlapping valves and at the sides at the girdle; the only sculpture visible is narrow growth grooving parallel with the margin of shell, but in the anterior valve there is some evidence of broad ray-ribbing or folding.

Inside.—Pale blue, eaves slightly spongy and overhung, but insertion plate extends beyond; teeth straight edged and fairly sharp, slits broad; head valve 8, median valve 1/1, tail valve unslit, without true insertion plate, the articulamentum being thickened at the edge. Sutural laminae well produced, straight along front line, sinus between wide in median valves and almost joined across the median line by a shallow extension of the articulamentum; in tail valve the jugal sinus is narrower and the laminae do not join across the median line; in all valves the tegmentum is bowed outwards in the jugal sinus.

Girdle.—The "short horny spines which are scarcely raised above the surface," mentioned in Haddon's type description, are short, blunt spicules or elongate scales (either term can be used), the one measured was $75\ \mu$ long and $25\ \mu$ wide; these are packed so closely together that only the rounded ends are visible, and give the spongy appearance mentioned by Haddon.

Measurements.—Given by Haddon: 40×27 mm., divergence 125° ; 32×18 mm., divergence 130° ; 45×25 mm.; S.A. Mus. example disarticulated. Head valve, 7.75×3.5 mm.; median valve, 10.5×5.5 mm.; tail valve, 8×4 mm.

Note.—Haddon described and figured a second species of *Plaxiphora* from Tristan da Cunha, under the name *P. carpenteri*, from a single very juvenile costate example, 14×9 mm. I would point out the possibility that there is only one variable species represented in that island. In Australia, along the coasts of Victoria, South Australia, Tasmania, and Western Australia, we have a costate form and a non-costate form living together in most places in varying proportions according to the localities. It appears there are intermediate forms between these, and although three names at least have been proposed

for special forms, we believe they will prove to be representatives of one very variable species. Also be it noted that in the juvenile stage the costate sculpture is usually much stronger.

Haddon states that of the four examples the two larger were dredged in 100 and 150 fathoms respectively, and the two smaller were shore shells. In Australia this species is essentially littoral in habitat. The set in the South African Museum were collected on the shore.

Family ISCHNOCHITONIDAE Pilsbry.

Subfamily CHAETOPLEURINAE Thiele.

Chaetopleura papilio (Spengler).

(Pl. III, figs. 32, 33.)

Chiton papilio, Spengler, Skriv. Nat. Sels., p. 86, 1797; *C. castaneus*, Quoy and Gaimard (not Wood), Zool. Voy. d'Astrol., p. 387, pl. lxxiv, fig. 33; *C. watsoni*, Sowerby, Mag. Nat. Hist., p. 288, 1840; Conch. Illust., figs. 81, 82, 130. *C. papilio*, Krauss, Die Südafrik. Moll., p. 41, 1848; Reeve, Conch. Icon., pl. vi, fig. 32 (*a, b*). *Chaetopleura watsoni*, Thiele, Das Gebiss der Schnecken, ii, p. 380, pl. xxxi, fig. 15 (dentition); *C. papilio*, Thiele, Revis. Syst. Chit., p. 74, 1909; Pilsbry, *loc. cit.*, xv, p. 72; Ashby, *loc. cit.*, p. 90; Thiele in Schultze, Forsch. Reise, iv, p. 269, 1910.

General Appearance.—Very strongly raised, slightly carinated but steeply arched; dorsal-pleural area very finely more or less longitudinally grooved; lateral areas raised, upper portion smooth, outer irregularly, finely, radially grooved, with scattered, circular pustules. Colour, vandyke brown to chocolate (Ridgeway, pl. xxviii), dorsal area darker brown edged paler.

Head Valve.—Strongly raised, upper half smooth, lower irregularly, sub-obsolete, radially grooved and decorated with irregularly spaced rows of circular, convex pustules; ground colour irregularly flecked with pale markings.

Median Valve.—The median valves vary in shape in the same example to an unusual degree. Valve 6 is the least damaged and is now described: elevated, keeled near the beak and arched anteriorly, side slope steep and slightly convex, dorsal-pleural area closely longitudinally grooved, the portion of the pleural area abutting on the lateral forms a shallow trough, over a good part of which the grooving is absent; lateral area raised, almost smooth except for

scattered, somewhat irregular, radial rows of small, circular, convex pustules, all areas crossed by growth grooves.

Tail Valve.—Raised, arched, mucro median, grooving sub-obsolete in dorsal-pleural area, portion behind mucro steep and slightly convex, most of area smooth but some faint, widely spaced grooving and scattered pustules, similar to the lateral areas, towards posterior margin.

Inside (articulamentum).—White outside and pinkish brown towards centre of all valves. Head valve badly broken, insertion plate seems well produced forward and multislit, eaves solid. Median valve—sutural laminae large, produced forward, joined across the middle line by a bilobed extension of the articulamentum, a slit on either side almost separating this process from the sutural laminae, the centre of this process in the jugal sinus is subdentate; slits 1/1. Tail valve—insertion plate narrower than that of head valve, slits 9, teeth rather blunt, irregular, and some propped and fluted, much as in the genus *Callochiton*, others only grooved, edge of teeth rounded and irregular, sutural laminae and process in jugal sinus similar to median valves.

Measurements.—Whole shell before disarticulation, dry and a little curled, 38×20 mm.; other examples up to 48×26 mm.; head valve too damaged to measure; median valve No. 6, 17.5×12 mm.; tail valve, 13×7.5 mm.; angle of divergence, 100° .

Habitat.—S.A. Mus. (Nos. 4887, 4889), Kalk Bay, False Bay. Lüderitzbucht (Thiele).

Chaetopleura pertusus (Reeve).

(Pl. III, figs. 34–36.)

Chiton pertusus, Reeve, Conch. Icon., pl. xvi, fig. 88, 1847; *C. pustulatus*, Krauss, Die Südafrik. Moll., p. 42, pl. iii, fig. 7, 1848; *Ischnochiton pertusus*, Pilsbry, Man. Conch., xiv, p. 103, pl. xx, figs. 18–19; *I. pertusus*, Carpenter MSS., quoted by Pilsbry, p. 104 (not of Reeve); *Chaetopleura pustulatus*, Pilsbry, loc. cit., xv, p. 73, pl. x, figs. 23–26, 1893; Ashby, Mal. Soc. Lond., xviii, pt. 2, p. 90, 1928; *Ischnochiton pertusus*, Ashby, *ibid.*, p. 90.

Introduction.—The following is Reeve's description of his *Chiton pertusus*: "Shell oblong ovate, valves elevated in the middle, very closely grooved throughout, ridges of the central areas thin, converging towards the umbones, interstitial grooves pricked, posterior edge of the valve serrated; dark red sprinkled with a few minute white dots, ligament horny, very sparingly beset with short bristles."

Locality.—Simons Bay, Cape of Good Hope.

Pilsbry referred *C. pertusus* Rve. to the genus *Ischnochiton* on the strength of MSS. notes of Carpenter on two examples on the Cuming Coll. Brit. Mus. It is quite evident that the examples referred to by Carpenter were not Reeve's shell at all; for Reeve stated that the girdle of his *C. pertusus* was "horny, very sparingly beset with short bristles," whereas the shell described in Carpenter's notes possessed "ischnoid scales . . . imbricating and striated." Mr. G. C. Robson has kindly sent to me for this examination the shell Carpenter described; it has, as Carpenter states, typical ischnoid girdle scales, and obviously is not the shell described by Reeve.

I propose to recognise Reeve's *C. pertusus* in *Chiton pustulatus* Krauss, for Reeve's description, figure, and locality can well be applied to that species; as *C. pertusus* Rve. antedates *C. pustulatus* Krauss, this latter name becomes a synonym of the former.

General Appearance.—The example disarticulated (S.A. Mus., No. 6766) from St. James, False Bay, is a curled and faded specimen, probably was picked up on shore and had been bleached by sunshine.

The ground colour is pinkish brown, the dorsal ridge in valve 2 is cream white, a narrow streak of same colour is present near the beak in all median valves. Shell is carinated, side slope rather steep and slightly convex, dorsal and pleural areas longitudinally ribbed with irregular bridging, which near the beak forms a complete network; lateral areas and end valves beset with scattered pustules and ray ribbed in varying degrees. Girdle leathery, beset with scattered long hairs and scattered very short, stout spicules.

Head Valve.—Raised, probably smooth at apex; in example described this is broken and worn, slope of valve almost straight (very slightly convex), steep, sculptured with shallow, irregular, broad, radiating riblets; down the centre of each riblet is a row of pyriform to circular, convex, widely spaced grains; the surface of shell, apart from this sculpture, is smooth, a few riblets bifurcate.

Median Valve.—These valves vary considerably in longitudinal measurement, slightly carinated, side slope slightly convex, becoming straight towards girdle; the dorsal area is not defined; the dorsal-pleural area is decorated with longitudinal rows of narrow, beaded, granulose riblets, the grains are widely spaced; on the umbo some of these riblets converge, the interspace between the riblets is about three times the width of the riblets themselves and is deeply and widely pitted; on the anterior third, especially towards the beak, the

riblets converge and the pits become proportionally smaller and closer together, forming a complete cellulose or network sculpture in the juvenile portion of the shell. Krauss describes the dorsal-pleural area as "longitudinally subgranose and cancellated," and the lateral area as "delicately punctulate and sparsely sculptured with elevated cylindrical pustules" (Pilsbry's translation). In some of the valves this description is complete, in others there are in the lateral area shallow ray ribs similar to the anterior valve; the small punctures referred to by Krauss are widely spaced and follow the shallow groove between the riblets where present.

Tail Valve.—Medium size, mucro slightly ante-median, raised, slope behind commencing rather steep and rapidly becoming flat, slightly concave towards the girdle. Sculpture in front of mucro completely bridged across, forming a complete network or lattice-work pattern; behind the mucro sculpture similar to head valve, except the ray-riblets are absent on portion immediately behind mucro.

Inside (articulamentum).—White with a pink blotch on either side of the beak. Head valve—insertion plate produced forward and slightly thickened at slits; slits 10, deeply cut; sinus carried to the tegmentum; teeth thick, rather blunt, with some shallow and inconspicuous groovings on upper side. Median valve—sutural laminae large and produced forward, anterior edge straight, jugal sinus medium but possessing a bilobed extension of the articulamentum which is notched on either side and finely dentate in centre; callus pronounced, tegmentum folded over at the posterior margin. Tail valve—sutural laminae shallower than in the median valves, process in the jugal sinus present but not produced beyond the tegmentum as in median valves, edge straight not bilobed; insertion plate short, very thick, slits 14 and very broad, the 2 lateral teeth on either side similar to those of head valve but the centre ones are small, the slits are widest in the centre, teeth more or less grooved and propped; the eaves in all valves overhang and are much thickened on the inside.

Girdle.—All Krauss says about the girdle is "Reddish-yellow, sparsely clothed with long brownish hairs." The example under examination seems to have been almost three times the length of the specimen described by Krauss; quoting from my notes: Girdle leathery, beset with scattered long hairs and scattered, very short, stout spicules. The other example without any date, from same museum, which I call No. 2, has scattered all over the girdle small

clusters of slender pale brown hairs, and in addition portions of the girdle are beset more closely with short, stout, pointed spicules, a large proportion of which are dark brown; the girdle surface being covered with minute, arenaceous scales through which the bunches of hairs and spicules push their way.

Measurements.—The whole shell, which was dry and curled, is estimated to have measured 38 mm. in length. Head valve, 8.5×5 mm.; median valve, 10×5.5 mm.; tail valve, 5×7.5 mm. Angle of divergence, 90° .

Habitat.—The example S.A. Mus., No. 6766, from St. James, False Bay; the other example I am placing with this species is without data. Simon's Bay (Reeve), Natal, on shore (Wahlberg), two valves from Port Alfred, U.S. Nat. Mus., No. 250622.

Chaetopleura destituta Sykes.

(Pl. IV, figs. 37–39.)

C. destituta, Sykes, Proc. Mal. Soc. Lond., v, p. 195, text-fig., 1902; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 90, 1928.

Introduction.—In the material from the South African Museum are two examples without name or data, Nos. 4874 and 4880 respectively; * the latter has a note attached: “? *C. setiger*, idenf. J. H. Ponsonby”; both these, I am confident, may be rightly referred to Sykes' species; the following is the description of No. 4874 except where otherwise stated.

General Appearance.—Description of the larger No. 4880; shell slightly carinated but much flatter than *C. papilio*; valves beaked, dorsal-pleural area mostly smooth but showing a little longitudinal grooving on most valves, end valves and lateral areas almost unsculptured except for growth lines and a little shallow, radial ribbing and a few small pustules showing in places; the girdle is leathery, with scattered dark-coloured spines and encroaches at the sutures. Colour, No. 4880 vandyke brown; smaller disarticulated example, No. 4874, walnut brown (Ridgway, pl. xxviii).

Head Valve.—Broad and flat, without ornamentation except for shallow, broad, sub-obsolete ray-ribs.

Median Valve.—Carinated, flat; side slope shallow, convex; dorsal-pleural area showing on and near the jugum, shallow, sub-obsolete, longitudinal grooving; the portion of the pleural area abutting on the lateral area forms a shallow trough; lateral area shallowly raised;

* Probably from Sea Point, Table Bay.—EDITOR.

most of the pleural and all the lateral area is without sculpture except for shallow, concentric growth grooves.

Tail Valve.—Laterally broad and shallow, mucro median, anterior portion without sculpture except shallow growth grooves, posterior portion possessing shallow, sub-obsolete ray-ribs and growth grooves.

Inside (articulamentum).—Anterior valve broken, only 4 teeth remaining, insertion plate well produced forward, multislit, the existing 4 teeth are rather blunt and straight edged. Median valve No. 7—sutural laminae large but less produced forward than *C. papilio*, the jugal sinus possesses a spade-like extension of the articulamentum which is not bilobed as in *C. papilio*, the two lateral slits are carried to the tegmentum, also this process is more or less vertically grooved throughout. Tail valve—sutural laminae and jugal sinus similar to median valves; insertion plate narrower than head valve, is damaged, but slits have been 10; teeth irregular and those present mostly straight edged, irregularly fluted on outside.

Measurements.—The larger, No. 4880, 68×34 mm.; No. 4874, 40×25 mm. Head valve too broken to measure; median valve No. 7, 18×10 mm.; tail valve, 14.5×8.5 mm. Angle of divergence, 110° .

Conclusion.—Although the sculpture is variable and what there is approaches *C. papilio*, the form of shell seems to indicate a distinct species.

Dinoplax gigas (Gmelin).

(Pl. IV, figs. 40–42.)

Chiton gigas, Gmelin, Syst. Nat., xiii, p. 3206, 1788; Spengler, Skriv. Nat. Sels., iv, p. 101, 1795; Wood, Gen. Con., p. 12, 1814; Brugière, Ency. Meth., clxi, fig. 3; Lamarck, An. s. Vert., vii, p. 490; Blainville, Dict. Sci. Nat., xxxvi, p. 543; Reeve, Conch. Icon., fig. 65; Krauss, Die Südafrik. Moll., p. 40, pl. iii, fig. 3 (young); H. and A. Adams, Gen. Rec. Moll., p. 475; Sowerby, Marine Shells S. Africa, p. 50. *Chaetopleura gigas*, Shuttleworth, Bern. mitt., p. 67, 1853. *Acanthopleura gigas*, Gray, P.Z.S., 1847, pp. 68, 169. *Chiton sub-gigas*, Blainville, Dict. Sci. Nat., p. 543 (juvenile); *C. albus*, Barbut, Gen. Ver. of Lin., pt. 2, 1788 (not of Linn.). *Dinoplax gigas*, Pilsbry, Man. Conch., xiv, p. 254, pl. lvii, figs. 21–32, 1892; *D. fossus*, Sykes, Proc. Mal. Soc. Lond., iii, p. 277, 1899; *D. gigas alfredensis*, Bartsch, U.S. Nat. Mus. Bull., xci, 1915; Thiele, Rev. Syst. Chitonen, p. 73, 1909; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 83.

Introduction.—This species is most variable in sculpture. Ashby

(*loc. cit.*, p. 83) discusses the extent of variation very fully and concludes the discussion in the following words. "It must be admitted that the coarsely sculptured form described by Sykes as *D. fossus* and the minutely sculptured form described by Bartsch as *D. g. alfredensis* are sufficiently different to warrant specific separation provided there existed no intermediates, or if the most diverse forms were limited to definite localities; in this last case they might have been treated as subspecies, as was done by Bartsch in his *alfredensis*, but in face of the fact that all three forms occur at Port Alfred and that a complete series of intermediates from one extreme to the other can be obtained, we cannot in my opinion do other than consider *D. fossus* Sykes and *D. gigas alfredensis* Bartsch as synonyms of *D. gigas* (Gml.), retaining these names to distinguish the respective varieties if so desired."

General Appearance.—Broad, strongly carinated, the lateral areas much raised, end valves and lateral areas decorated with numerous, broken, radial riblets, sub-obsolete in some examples; the dorsal-pleural area varying much in the strength of the ornamentation, the coarser forms showing sublongitudinal, irregular, wavy riblets crossed by transverse riblets, forming an irregular cellulose sculpture, while the smoother forms so modify this sculpture that they appear minutely decussate and in places merely punctate. The girdle in perfect examples is densely spiculose.

Head Valve.—Large and broad, decorated with numerous, closely packed, broken, radial riblets; several deep, concentric growth sulci are present; the interstices are irregularly pitted, giving a pectinate appearance to the sides of the riblets.

Median Valve.—In the example photographed, which represents var. *fossus*, valve 3 certainly has a slight beak, is strongly carinated, side slope straight, the dorsal ridge is almost smooth, the dorsal-pleural area is decorated with numerous wavy, sublongitudinal, bifurcating riblets which contract and widen in a most peculiar way, these riblets are separated from one another by deep interspaces, which are termed by Sykes in his description of *fossus* "stab-like markings." The lateral area is strongly raised and decorated with 7 ray-riblets, the interspaces are minutely granulose. The colour of the valve is silvery grey, mottled with pale brown; the beak is red.

Tail Valve.—Small as compared with other valves, carinated but flat, dorsal area raised and narrowly wedge shaped, mucro post-median; anterior to mucro, sculpture similar to dorsal-pleural area

in median valves; area posterior to mucro, sculpture similar to that of head valve, but strongly raised.

Inside (articulamentum).—White shading to grey or pink towards the apex. Head valve—insertion plate greatly thickened in senile shells, and eaves then almost absent, slits 10; teeth fairly regular, sharp edged, but grooved on outside, simulating serrated teeth. Median valve—insertion plate much thickened at slit, slit $1/1$, eaves at slit. Tail valve—insertion greatly thickened, slits 10, inconspicuous, narrow, and cut on diagonal; insertion grooved, almost laminated outside; sutural laminae in median valves well produced, straight edged, joined across middle line, jugal sinus only indicated by bilateral slit, but in tail valve the sutural lamina are more produced forward, anterior edge curved outwards, jugal sinus almost completely occupied by a spade-like process, which is bowed outwards.

Girdle.—Spiculose in juvenile or well-preserved examples, densely clothed with short, mostly brown spicules measuring $90 \times 13 \mu$, also at sutures, and scattered bunches are slender spicules, and also with these and at girdle-fringe, long, stout, striate, white spicules; one measured was $560 \times 75 \mu$.

Measurements.—Senile shells roughly measured because curled, 110×50 mm.; 104×53 mm. Separate valves of senile shell No. A5333: head valve, 38×22 mm. (eroded); median valve, 40×20 mm.; tail valve, 29×16 mm. Angle of divergence, 110° . Gills extend full length of foot.

Habitat.—Port Alfred (example here figured); Kowie; Kalk Bay; Algoa Bay; Durban.

Subfamily ISCHNOCHITONINAE Pilsbry.

Ischnochiton oniscus Group.

Pilsbry (*loc. cit.*, p. 98) proposed an "*Ischnochiton textilis*" Group, but as is shown later under the heading *I. textilis* (Gray), Pilsbry was under a misconception as to the true character of Gray's species, and had concluded that it was a near ally of *I. oniscus* (Krauss), whereas it belongs to Pilsbry's group *Radsiella*. In the material placed in my hands there are four distinct species in all of which the sculpture is so alike that it is difficult to separate them on shell sculpture alone. In all the sculpture may be termed minutely decussate. But each of the four are easily distinguished by the character of the girdle scales. It must be remembered that to see these characters clearly it is necessary that the girdle scales are clean

dry, and not eroded by the action of chemicals such as formalin, the action of which is fatal to fine sculpture. The four species referred to the above group are *I. oniscus* (Krauss), *I. elizabethensis* Pilsbry, ? *I. ludwigi* (Krauss MSS.) Pilsbry, and *I. hewitti* n. sp. The identification of *I. ludwigi* from Krauss' definition is doubtful.

Ischnochiton oniscus (Krauss).

(Pl. IV, figs. 43-46.)

Chiton oniscus, Krauss, Südafrik. Moll., p. 39, pl. iii, fig. 4, 1848. *Ischnochiton oniscus*, Pilsbry, *loc. cit.*, xiv., p. 100, pl. xx, fig. 125, 1892; Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 133, 1894; Sykes states: *I. macgillivrayi* Pilsbry (in part); and *I. viridulus* of "Challenger," not of Couthouy; *I. oniscus*, Thiele, *loc. cit.*, pp. 111, 113; Ashby, *loc. cit.*, p. 90; Sykes, Naut., xii, No. 3, p. 41, July 1898.

The following is Pilsbry's description: "The valves as well as the girdle appear smooth to the naked eye, but the lateral areas are visible. Under the lens the central areas are very finely punctate on the dorsum, and on the pleural they are longitudinally striated; these striae continue upon the lateral areas, becoming wavy striae there. The end valves have feeble wavy striae towards the margins, and have 10 slits in their insertion plates. The intermediate valves are strongly convex, 5 mm. wide and 4 mm. long, rounded at both sides, and having a single slit in each insertion plate."

Slits.—I have disarticulated two examples: No. 1 measuring 19×6 mm.; head valve, 12 slits; median, 1/1; tail, 10. No. 2, head valve, 9; median valve, 1/1; tail valve, 9 slits. While in the genus *Acanthochiton* the slitting in the end valves is most regular, in the ISCHNOCHITONIDAE and other genera where there is multi-slitting, even in the same species there is often irregularity in the slitting of the end valves. Angle of divergence, 90°.

Scales.—The girdle scales are quite distinct from those of *I. elizabethensis* Pilsbry in that they are smaller, more or less opaque, brown in colour except the edges, which are whitish, flat, not imbricated or turned over or polished, as in that species; they are partly erect, but placed so closely together that only a small part of each scale is visible, making them appear smaller than they really are; the angle at which the scales are attached to the girdle gives them a chaffy appearance. Under a simple lens, ×20, the scales appear smooth (as stated by Pilsbry), but under 65 mag. the striae can be just

perceived, and when magnified about 130 times the striae are well marked, about sixteen extending up to the apex of each scale; the scales measure $87\ \mu$ to $110\ \mu$ in width.

Colour and Pattern.—In my paper on the Chitons in the Turton Collection (*loc. cit.*) I pointed out that colour and pattern have little or no specific value in *Polyplacophora*. This species and *I. elizabethensis* both vary and have many colour patterns in common, and, strange to say, similar colours and patterns recur in Australian and New Zealand species. I add, "We are hardly justified in assuming that similarity of environment is the only inducing cause." Then follow a list and description of eight colour varieties lettered A to H.

Ischnochiton oniscus alfredensis n. subsp.

(Pl. V, fig. 54.)

Introduction.—From the Oxford Museum comes a single example of a very elongate form of *Ischnochiton* closely allied to *I. oniscus*; from the Transvaal Museum come two examples, both much curled, which I am considering conspecific with the first named, which was collected by Col. Turton at Port Alfred, while those from the Transvaal Museum were collected at Umkomaas, Natal. In face of the very limited available material and the inconspicuous and indefinite character of the sculpture, I am contenting myself with simply indicating the differences between it and its near allies.

Comparisons.—It differs from *I. elizabethensis* in possessing much smaller girdle scales and in the longitudinal ribs of the pleural area being further apart; from *I. oniscus* sensu stricto in that the girdle scales are a little larger, are bent over, and imbricating and semi-translucent and polished. The longitudinal ribbing in the pleural area is more spaced and only traverses that area towards the girdle. In form it differs from both in that the whole shell is narrower, longer, more elevated, and carinate; the tail valve is proportionally longer, especially in the larger example, which is figured and selected as the holotype. The anterior edge of the sutural laminae is straight as in *I. elizabethensis*, but the jugal sinus is narrower than that species; the dorsal ridge is smooth, but this may not be constant.

Inside (articulamentum).—Greyish white. Head valve—slits 10, teeth sharp and straight edged, insertion plate well developed, eaves deep. Median valve—slits 1/1, sutural laminae anterior, margin straight, jugal sinus narrower than *I. oniscus* sensu stricto or *I. elizabethensis*. Tail valve (slightly damaged)—10 slits, jugal sinus similar.

Measurements.—Holotype, 12.5×5 mm. (dry, girdle curled); paratype (disarticulated) — head valve, 3.5×2 mm.; median valve, 4×2 mm.; tail valve, 3.5×2.5 mm. Angle of divergence, 90° .

Note.—The tail valve of the disarticulated paratype is beautifully ray-marked with dark rays, which look like hollows between ribs.

Ischnochiton elizabethensis Pilsbry.

(Pl. IV, figs. 47–49.)

I. elizabethensis, Pilsbry, Naut., viii, p. 9, 1894; *Chiton marginatus*, Sowerby, Catalogue Marine Shells of S. Africa, p. 50, 1892 (non-Pennant); Sykes, Naut., xii, No. 3, p. 41, 1898; Ashby (*loc. cit.*), p. 90.

The following is a copy of Pilsbry's type description: "Shell small, elliptical-oblong, elevated at an angle of 105° ; carinated, the side slopes somewhat convex. Colour whitish or buffish olive, finely and closely mottled all over with light olive green, or having angular patches of olive at the sides of each valve; sometimes with black-green triangles on the ridge of some valves; the posterior margins of valves more or less tessellated light and dark. Girdle indistinctly tessellated with numerous small, green bars or patches. Intermediate valves not beaked, valves finely granulated throughout, the sculpture closely resembling that of *Trachydermon cinereus* L.; lateral areas slightly raised; posterior valve having the central mucro somewhat prominent, posterior slope concave. Interior bluish, with a pair of darker green rays in each intermediate valve; the inflected posterior margin tessellated. Sutural plates small, separated by a very wide, straight, smooth sinus. Anterior valve having 10, intermediate valves 1/1, posterior valve 11 slits; teeth smooth and sharp, slit-rays showing as whitish lines; posterior tooth in intermediate valves short, removed from the posterior margin of valve by its own length. Eaves narrow. Girdle densely clothed with smooth, flattened, imbricating scales. Length, $10\frac{1}{2}$ mm.; breadth, 7 mm. Habitat, Port Elizabeth, South Africa."

Slitting of Insertion Plate.—Example (1) before disarticulation measured 15×8 mm., interior white; head valve, 13 slits; median valve, 1/1; tail valve, 10; (No. 2) head valve, 12; median valve, 1/1; tail valve, 10.

Girdle Scales.—Under pocket lens, $\times 20$, very thin, translucent, flat, and polished, very broad, edge smooth; if detached, the scale is seen to be much bent over, causing complete imbrication, the

exposed portion only shows a little bending. Under 65 mag. the anterior portion of scale is seen to be smooth, but behind that there is distinct scratching; the number of parallel striae counted under 130 mag. are 25-30; scales measured were 150-200 μ .

Comparisons.—In *I. elizabethensis* the sculpture is less coarse than in *I. oniscus*, the granules more circular; in *oniscus* the granules of the pleural area are confluent and arranged in distinct longitudinal rows right across this area; whereas in *elizabethensis* this longitudinal arrangement of the grains forms wavy riblets which do not completely cross the pleural area; briefly, in addition to the stronger sculpture of *I. oniscus*, the scales are much smaller, semi-erect, and have a chaffy appearance; whereas in *I. elizabethensis* the scales, in addition to being larger and broader, are polished, translucent, and imbricating. Both species vary extremely in colour pattern. Ashby (*loc. cit.*) describes ten colour varieties, lettering them A-J.

Ischnochiton hewitti n. sp.

(Pl. V, figs. 50-53.)

Introduction.—There are three shells from the Albany Museum (Nos. 8079, 8082, and 8085), and five from the South African Museum (No. 6757). All are bleached, but those under No. 6757 seem to have been immersed in some eroding solution, perhaps formalin, which has much injured the sculpture. These all show a distinct type of girdle scale, with a few, mostly three, strong, widely spaced ribs, instead of the exceedingly minute, numerous, parallel scratching present in the three preceding species. The best of the rather poor examples available was sent to me by Mr. John Hewitt, from the Albany Museum, who has been chiefly instrumental in getting me to undertake this monograph, and I have much pleasure in naming this species after him.

General Appearance.—Elliptical, subcarinated, slightly beaked, lateral areas raised, sculpture generally minutely decussate, girdle clothed with more or less erect scales, which are ornamented with 3-5 very strong riblets, which are widely and deeply separated. The whole shell is biscuit colour; but, as the inside is pale bluish green, the tegmentum may have been somewhat the same.

Head Valve.—Raised, much eroded, sculpture minutely granulose, a little sub-obsolete ray grooving is suggested, 2 concentric growth grooves.

Median Valve.—Arched, not carinated, side slope convex, dorsal

area is not defined; the dorsal-pleural area decussated with minute granules arranged at first in diagonal rows, gradually becoming larger and arrangement of rows longitudinal towards the girdle, the beak is sub-obsolete; lateral area is raised, 2 shallow growth sulci, and towards the girdle there is a slight suggestion of shallow ray grooving (it is possible that this feature may be more in evidence in larger and better preserved specimens).

Tail Valve.—Large, mucro ill defined, central, anterior portion small and minutely decussate, posterior portion fully twice the size of the anterior from which it is separated by a diagonal fold; general sculpture minutely decussate, but towards the girdle there are 2 well-defined, concentric, growth grooves; between the growth grooves towards the girdle are concentric rows of large grains or shallow knobs, so arranged that the grooves between are numerous and radial; this suggests the possibility of the presence of broken, radial ribbing in the outer portion of senile shells.

Inside (articulamentum).—In daylight pale greenish blue. Head valve—teeth irregular, edge straight and sharp, slits 13, eaves deep. Median valves—slits 1/1, sutural laminae small and weak, jugal sinus very broad. Tail valve—teeth very irregular in width, otherwise as in head valve, slits 12, sutural laminae weak, jugal sinus broad.

Measurements.—Whole shell (No. 8085), 13×7 mm.; the largest (No. 8079), 14.5×7.5 mm.; head valve, 2.5×4.5 mm.; median valve, 2×5 mm.; tail valve, 3×4.5 mm. Angle of divergence, 90° .

Comparisons.—As before stated, the girdle scales are most distinct as regards the sculpture in *I. hewitti*; the longitudinal riblets in pleural area are shallow, subgranulose, and flattened at top, and direction of riblets wavy-diagonal; whereas in *I. oniscus* these riblets are almost straight, outer riblets not granulose, and strongly raised; as compared with *I. elizabethensis* the granules in the pleural area are better defined but smaller.

Habitat.—Table Bay.

Note.—Since typing the above I have found a box with a few more of the above species (S.A. Mus., No. 6757), also from Table Bay, all eroded and labelled *I. elizabethensis*. Some have a distinctly bluish-coloured tegmentum. If the erosion is due to natural causes, the species may live in shallow water and belong to the half-tide horizon; if so, non-eroded examples should be looked for in positions shaded from sunlight or from complete exposure thereto.

Ischnochiton ludwigi (Krauss MSS.) Pilsbry.

(Pl. V, fig. 55.)

I. ludwigi, Pilsbry, Man. Conch., xiv, p. 99, 1892.

Pilsbry (*loc. cit.*, p. 100) quotes Krauss MSS. description of a var. *punctulata*, and on page 99 quotes another MSS. name of Krauss *Isch. zebra*. As nothing in respect to these seems to have been published by Krauss, and the notes published by Pilsbry without figures are quite inadequate for identification, we must consider both names as *nomina nuda*. On page 99 Pilsbry writes as follows: "Krauss describes specimens collected by him, and which he at one time considered a new species which he intended naming *C. ludwigi*. His description is as follows: Shell ovate-elongate, semi-pellucid, sub-carinated; white in the middle; the sides ashen green, often spotted with brown; interior white. Front valve lunate, tail valve rather depressed, submucronate in the middle; intermediate valves having the central areas finely punctate on the ridge, longitudinally striolate at the sides; lateral areas and end valves radiately rugulose-striated. Girdle ashen, submaculated, scaly, the scales small and oblong, *excessively finely multicarinated*. Length, 22 mm.; breadth, 11 mm. Table Bay."

Pilsbry considered that this belonged to the group I call "*oniscus group*." It will be seen that the definition deals mostly with colour and pattern, features which in Chitons have little or no specific value. The only distinctive portion of the definition are the words "the scales small and oblong, *excessively finely multicarinated*."

In the same box from the Albany Museum with *I. hewitti*, all under the name *I. elizabethensis*, was a dissimilar example, No. 5078, measuring 9×5.5 mm. dry. The girdle scales are distinct from any other members of the "*oniscus group*," and correspond with Krauss' description of the scales, as above. The sculpture is minutely decussate, but much hidden by some gummy matter; I suggest that it be identified with a query as *I. ludwigi* Pilsbry, as he was the first publisher of this name. The correctness of this somewhat doubtful determination must be left till more and larger material is available; if no more examples are met with I should recommend this example being considered an exotic specimen, and consider *C. ludwigi* (Krauss MSS.) Pilsbry a *nomen nudum*.

Short Key of the *Oniscus* Group.

- A. Girdle scales smooth, or striae reduced to mere scratching.
1. Scales variable in size, flat or biscuit shape, not strongly bent over, suberect *oniscus*
 2. Scales very broad, apex smooth and polished, much bent over and completely imbricated *elizabethensis*
- B. Girdle scales coarsely ribbed.
1. Scales very coarsely ribbed, with few riblets (3 to 5) *hewitti*
 2. Scales with numerous riblets, riblets less than half as wide as in *hewitti* *? ludwigi*

Subgenus *Radsiella* Pilsbry.

Section *Radsiella*, Pilsbry, Man. Conch., xiv, pp. 54, 139, 1892.

Pilsbry defines his section *Radsiella* as follows: "Valves and girdle entirely similar to the ordinary *Ischnochiton*, but the insertion plates of the intermediate valves having two or several slits," with *Ischnochiton tridentatus* Pilsbry, the type species. Pilsbry, as shown hereunder, did not include *I. textilis* (Gray) in this section, and I had in MSS. proposed to place the following three distinctive South African forms under a new subgenus, which I proposed to name "Diktuonus" on the ground of the multislitting of the median valves and of the peculiar network sculpture. I then noted Pilsbry's *Radsiella* section; I have not seen the type species *I. tridentatus* from Lower California, but his definition equally fits the three following species: *I. textilis* (Gray), *I. delagoensis* n. sp., and *I. tigrinus* (Krauss); should the three species, on comparison with *I. tridentatus*, be found to be not consubgeneric, I suggest that the name "Diktuonus" be adopted therefore, with *I. textilis* (Gray) as type species.

Ischnochiton (Radsiella) textilis (Gray).

(Pl. V, figs. 56-58.)

Chiton textilis, Gray, Spic. Zool., pt. 1, p. 5, 1828; *Ischnochiton textilis*, Pilsbry (part only), Man. Conch., xiv, p. 98 (non *textilis* Pilsbry, as described bottom of page 99); *I. textilis*, Thiele, loc. cit., p. 111, pl. viii, fig. 40; non *I. textilis*, Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 132, 1894. Thiele in Schultze, Forsch. Reise, iv, p. 269, 1910.

Introduction.—Pilsbry does not appear to have been able to see an example of the true *I. textilis* (Gray) and assumed it was allied to *I. oniscus*, this error being due to the brevity of Gray's description and the fact that his figure was useless. Until receiving one of Gray's cotypes from the British Museum it was my intention to

recognise Gray's *C. textilis* in *C. tigrinus* (Krauss), as it appeared to me that Reeve figured that shell under the name "*textilis*." But since receiving the cotype from the British Museum I realise that the shell I had described in MSS. is Gray's *textilis*. The following is Gray's definition: "Shell oblong, elongate, white, pellucid when young, green with a white central band; end valves and lateral areas of the middle valves finely, radially striated and concentrically wrinkled; central area closely and minutely punctated, and *behind* finely, longitudinally striated; margin (girdle) white, minutely scaly. Length one inch and a half." To make this brief description apply to this shell the word "*behind*" has to be emended to "*before*," as the median areas are longitudinally striated anteriorly only. Also Gray's remarks about the juvenile form quite probably do not apply to this species. I have seen no juvenile. I am accepting the example sent from the British Museum, No. P739, as being a true cotype of Gray's *C. textilis*.

General Appearance.—Shell rather shallow, arched not keeled; sculpture of dorsal-pleural area changing anteriorly in mature shells into coarse, wavy, longitudinal ribbing, with irregular bridging across; lateral areas and end valves decorated with radiating coarse rugose riblets; girdle unusually broad, in dried example 3 mm. on either side, representing a fraction over one-third of total width of the animal, probably a still larger proportion when alive.

Head Valve.—Valve large, raised, decorated with closely packed radiating riblets (which measure from $162\ \mu$ to $250\ \mu$ in width towards the girdle), these riblets are broken by several concentric growth grooves. Colour, cartridge buff (Ridgway, pl. xxx); the colour is deeper at the concentric grooves, forming banding of a deeper shade.

Median Valve.—Laterally broad, arched; the posterior third of the dorsal area is eroded on all specimens, including the example described; the dorsal area is not defined, the dorsal-pleural area is decorated with coarse network sculpture, the cells or mesh vary from lanceolate to ovate, but many near the umbo are confluent; near the anterior margin the network pattern is departed from and becomes a series of longitudinal, sinuate, highly raised, convex ribs, the grooves between being deep and narrow, both the ribbing and the interspaces are irregular and in many places the ribs are confluent. In the largest of the four specimens from Saldanha Bay the network sculpture has been entirely eroded and only the conspicuous, sinuate, longitudinal ribs left on the anterior portion of shell. The lateral area is strongly

raised and decorated with bifurcating radial ribs, similar to those of the head valve but coarser, and are partially broken by deep, concentric growth grooves.

Tail Valve.—Valve large, mucro slightly ante-median, eroded, sculpture in front of mucro, similar to the dorsal-pleural area in the median valves; the portion of valve behind the mucro is same as in anterior valve except that the concentric growth grooves are more numerous and deeper, breaking the radial riblets almost into grains (300 μ wide).

Girdle is broad, 3 mm. wide, clothed with rather large imbricating white scales which are bent over anteriorly, the exposed portion appears smooth but under 65 mag. the basal half is seen to be closely scratched or shallowly grooved; it is possible that the grooving of the scales may have been affected by some solution in which the shells may have been placed.

Inside (articulamentum).—Inside white. Head valve—teeth sharp, slits 18, eaves overhanging, solid. Median valve—sutural laminae produced forward, jugal sinus very wide, teeth sharp, slits in valve 2, 4/4, but in valve 3, which is figured, insertion is broken. Tail valve—slits 14, all teeth except fourth same as head valve, but show a tendency to change in character, becoming irregularly crenate with corresponding short grooves inside, tegmentum bowed outward in the jugal sinus.

Measurements.—The shell described, S.A. Mus., No. A5340, before disarticulation was dry and curled, estimated 35×17 mm. In this condition the girdle occupies over one-third of the width; head valve, 9×5 mm.; median valve, 11×4 mm.; tail valve, 9×6 mm.; angle of divergence, 105° (valve 4).

Habitat.—Saldanha Bay (west coast); False Bay. Lüderitzbucht (Thiele).

Note.—Several examples, in spirit, have recently been sent to me by Dr. Barnard from Saldanha Bay; the largest measures 35×20 mm. Gills median, stopping 4 mm. short of either end of the foot. Gill laminae or plumes, 35/35.

Ischnochiton (Radsia) tigrinus (Krauss).

(Pl. V, figs. 59–62.)

Chiton tigrinus, Krauss, Die Südafrik. Moll., p. 38, pl. iii, fig. 5, 1848; *Chiton solea*, Sowerby, Conch., iii, fig. 61 (undescribed); *C. textilis*, Reeve (not Gray), Conch. Icon., pl. xvi, fig. 88, 1847;

I. tigrinus, Pilsbry, Man. Conch., xiv, p. 143, pl. xix, figs. 60–63, 1892 ; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 90, pl. vii, fig. 16, 1928.

Introduction.—I have selected an example given to me by the British Museum, because both in size and markings it is almost identical with the type described by Krauss.

General Appearance.—Elliptical, dorsal-pleural areas “cellulose or pricked,” lateral areas and end valves coarsely sculptured with radial granulose riblets, girdle clothed with rather large, finely striate, imbricating scales. Colour in disarticulated example somewhat faded, pale pinkish brown with wavy, sub-longitudinal banding of a darker shade ; I count four to five of these bands on each side of median valves ; this colour pattern is shown by Krauss in his figure. The South African Museum example, No. A5249, is uniformly cacao brown (Ridgway, pl. xxviii).

Head Valve.—Raised, carinated, side slope almost straight, decorated with about 70 closely packed, irregular, granulose, radiating riblets ; these are crossed by several granulose, concentric growth ridges ; three or more wavy colour bands are present.

Median Valve.—Raised, carinated, dorsal-pleural area decorated with a cellular or semi-network pattern, of which the interspaces are more or less circular ; lateral area raised, rather narrow, decorated with 7 rather confused but coarsely granulose, radial riblets, numerous growth grooves cross these ribs, the granulation at these points being very coarse, having the effect of together forming coarse granulose transverse ridges.

Tail Valve.—Raised, mucro almost median, anterior portion similar to dorsal-pleural area in median valves ; the slope immediately behind mucro is steep, rapidly becoming flatter, making the posterior slope slightly convex ; ornamentation similar to that of the lateral areas, although the concentric growth ridges are a little more marked ; there is immediately behind the mucro and in some of the interspaces a minute granulated surface to the shell ; colour banding and blotching is present.

Inside.—White to greyish white with a tinge of pink near the umbo. Head valve—eaves overhanging, insertion plate well produced, slits 16, deeply cut ; teeth sharp, straight edged. Median valve—sutural laminae fairly large, anterior edge almost straight, jugal sinus medium, tegmentum slightly bowed outwards in the sinus ; the slitting is irregular, valves 3 and 5 have 2 slits one side and 1 the other, valves 4 and 6 have 2/2 ; teeth sharp. Tail valve—13 slits, teeth sharp and fairly even.

Girdle.—Clothed with rather large, thin, imbricating scales which are finely striate.

Measurements.—Whole shell, 21.5×10.5 mm. (girdle not quite flat); head valve, 7.75×4.5 mm.; median valve (No. 5), 10×4.5 mm.; tail valve, 8×5 mm.; angle of divergence, 90° .

Habitat.—Examples before me from Port Elizabeth, Port Alfred, St. Sebastian Bay.

Comparisons.—This species is easily distinguished from *I. textilis* in that this shell is carinated and *textilis* is arched, the latter is distinctly broader; the sculpture of the dorsal-pleural areas in this is consistently throughout a cellulose or canvas-like sculpture, whereas *textilis* has a network sculpture in which the meshes are longitudinally drawn out, this sculpture changing anteriorly into wavy, longitudinal riblets; the jugal sinus in *textilis* is much broader than it is in *tigrinus*. It is distinguished from *I. delagoaensis* in that the latter possesses large-mesh network sculpture and no radial ribbing in the lateral areas.

Ischnochiton (Radsella) delagoaensis n. sp.

(Pl. VI, figs. 63–66.)

Introduction.—South African Museum, No. A6589, is a unique *Ischnochiton* collected by Dr. K. H. Barnard at Delagoa Bay. In this the network sculpture described in *I. textilis* attains its highest perfection; the beauty of this shell in sculptural design and delicacy of tracery is unsurpassed in any other member of this genus. It is with much regret that in the interest of accurate description I have been compelled to disarticulate this unique specimen, and the more so as the head valve is cracked.

General Appearance.—Elliptical, low elevation, subcarinated, side slope convex, the end valves and lateral areas ornamented with irregular, wavy, jagged riblets and a little netting, the dorsal-pleural area ornamented with large-mesh netting sculpture; girdle clothed with small, imbricating, striated scales; colour, all valves show pale blue blotches and all sculpture is pure porcelain white.

Head Valve.—Rather flat and wide laterally, porcelain white with scattered, irregular blotches or streaks of very pale greenish blue (possibly in the living shell these colour marks may be conspicuous); sculpture towards the apex network, at the apex itself (apex worn) probably minutely granulose; the outer half of valve is ornamented with vermiform, wavy, irregular riblets which on the lateral portions have a somewhat concentric arrangement.

Median Valve.—Rather flat, carinated, side slope not steep, convex, not beaked; ridge without sculpture, rest of dorsal area and pleural area sculptured with beautiful network; under 20 mag. the net is seen to be composed of strings white as porcelain, the mesh commencing small on the jugal tract and increasing rapidly both anteriorly and laterally, the net is drawn out longitudinally so that the mesh is a series of elongate rhomboids (one of these measured is $140\ \mu \times 87\ \mu$); the lateral area is raised, minutely granulose at the jugum (*i.e.* the juvenile portion of shell), changing into a series of partly diagonal, merging into sub-concentric, wavy, irregular riblets; but there is also on the anterior side of this area a little netting similar to that of the dorsal-pleural area except that the mesh is elongate vertically and not longitudinally.

Tail Valve.—Large, elevated, mucro median, the slope immediately behind vertical then concave, due to the rapid flattening of this portion; sculpture of the anterior portion similar to dorsal-pleural areas of median valves; the sculpture immediately behind the mucro is granulose, the rest of the posterior sculpture is composed of more or less parallel, wavy, or broken riblets, which are arranged longitudinally to commence with, but rapidly curving concentrically towards the middle line.

Inside (articulamentum).—White. Head valve—insertion plate shallow, slits 10, teeth sharp, irregular, slits deeply cut, eaves overhang. Median valve—slits 1/1, sutural laminae shallow, jugal sinus broad. Tail valve—slits 11. In median valves tegmentum is narrowly turned over but unsculptured.

Girdle.—Clothed with white, flat, thin, imbricating small scales, apparently smooth and polished, measuring laterally $150\ \mu$, much less vertically, under 65 mag. I could not detect any scratching, but under a higher magnitude I counted 12 striae on one scale.

Measurements.—Whole shell, 10×6.5 mm.; head valve broken; median valve, 4.75×2 mm.; tail valve, 4×2.5 mm.; angle of divergence, 100° .

Habitat.—Delagoa Bay.

Comparisons.—The large network sculpture of this species is very distinct from the cellulose sculpture of *I. tigrinus* Krauss; it more nearly approaches the sculpture of *I. textilis* Gray, but in that species the strands or riblets forming the network are much coarser and change anteriorly into coarse longitudinal ribs, a feature quite absent in the species under examination; also in *textilis* the lateral areas are radially ribbed, which is not the case in *delagoensis*. At first I

thought that this might be the juvenile form of *I. textilis*, but although in all the specimens of *I. textilis* before me the juvenile portion of the shell is eroded, I am satisfied from the data advanced that *I. delagoensis* is quite distinct.

Note.—Thiele, *loc. cit.*, p. 90, pl. ix, figs. 32–36, describes and figures a n. sp. of Chiton under the name *Chiton (Clathropleura) peregrinus* Thiele. The figure shows in the median valve a network sculpture that suggests *I. textilis*, but the other sculpture is certainly distinct. Thiele believed that it came from Algoa Bay.

Family CHITONIDAE Pilsbry.

Subfamily CHITONINAE Pilsbry.

Use of subgeneric names *Clathropleura*, *Rhyssoplax*, and *Anthochiton* discussed. Thiele (Das Gebiss der Schnecken, ii, p. 367, 1893) proposed the use of the name *Clathropleura* Tiberi (Bull. Soc. Mal. Italy, iii, p. 136, 1877) as a subgenus of the genus *Chiton* L., citing *C. siculus* Gray = *C. sulcatus*, and adopted this name throughout his later work of 1909. Pilsbry subsequently (Man. Conch., xv, p. 67) selected *Callochiton laevis* (Mont) as type of *Clathropleura* Tiberi. Iredale (Proc. Mal. Soc. Lond., ix, 1910) points out that Tiberi gave no diagnosis, but listed three species in his paper *C. laevis*, *C. corallinus* Riss., and *C. sulcatus*, with *C. siculus* Gray as synonym. Iredale then states that the concluding portion of Tiberi's paper containing the *C. siculus* Gray was printed on the cover of the next volume, dated 1878, and he therefore assumes that the two volumes were not published at the same time. He then cites *C. laevis* (already cited by Pilsbry, 1893) as Tiberi's type of *Clathropleura*. He then proposes the use of Thiele's subgenus *Rhyssoplax* with type *C. affinis* Issel as a substitute for the subgenus *Clathropleura* as used by Thiele, with *Anthochiton* Thiele, 1893, as a synonym; basing his treatment on the grounds (Int. Rules, Article 30A) that *C. siculus* Gray "was not included under the generic name at the time of its original publication."

I submit (1) that no evidence has been adduced to prove that the two volumes in which Tiberi's paper was published were not issued at one and the same time. (2) That the name "*C. affinis* Issel" was not published by Thiele until his second work of 1910. (3) That therefore Thiele's subgeneric name *Anthochiton*, with *Chiton tulipa* Quoy and Gaimard as type of the genus, dates from Thiele's earlier work of

1893, p. 377. (4) As no adequate definition has yet been published to warrant the elevation to generic status of any of the three names quoted above as proposed as subgenera by Thiele, I have in this monograph elected to use none of them. Their proposal was based almost entirely on characters of the radula.

Chiton tulipa Q. and G.

C. tulipa, Quoy and Gaimard, Voy. l'Astrolabe, Zool., iii, p. 389, pl. lxxiv, figs. 35-36, 1834; Krauss, Die Südafrik. Moll., p. 37; Reeve, Conch. Icon., pl. iii, fig. 18; Pilsbry, Man. Conch., xiv, p. 185, 1892; Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 134, 1894; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 87, 1928; *C. cymbiola*, Sowerby, Mag. Nat. Hist., p. 292, 1840.

The following is Pilsbry's description: "Shell oval, oblong, elevated, acutely carinated, the side slopes nearly straight. Surface smooth and polished throughout. Ground colour buff or whitish, suffused and closely mottled all over with reddish chestnut, fawn or purple brown, usually longitudinally streaked in the central areas, zigzagged or tessellated on the end valves, and articulated on the diagonal lines with the darker colour. Sometimes parts of some valves or several whole valves are of a uniform dark brown colour. The central areas are smooth except for slight growth lines and a microscopic granulation which covers the whole surface. Lateral areas well raised, flat, rarely with slight radii, smooth in the excavation at the diagonal line, a lens shows a few very short longitudinal grooves in some specimens. Tail valve elevated with central umbo. Interior very light blue green, each valve rayed with brown at the beaks. Anterior valve having 8, central valves 1/1, posterior valve 12 slits; teeth pectinated, eaves short, spongy, grooved along the teeth. Sinus narrow, denticulate. Girdle, solid, closely covered. Angle of divergence, 100° to 112°, with smooth, convex scales."

Habitat.—I have seen examples from the following localities: St. Sebastian Bay, Simons Bay, Camps Bay (west coast of Cape Peninsula), and Port Alfred.

Chiton tulipa alfredensis Ashby.

(Pl. VI, figs. 67-69.)

C. tulipa alfredensis, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 87, 1928. Ashby, in describing this variety or subspecies (which status is

justified must remain for workers on the spot to determine) on page 88, says: "The example I am selecting as type is, in common with the others, much curved, and measures along the dorsal ridge about 45 mm., has 10 to 12 grooves, with their corresponding short longitudinal ribs on each valve. In other respects they are similar to *C. tulipa* s.s. Pilsbry states: 'The short traces of grooves at the diagonal line are rarely visible without a lens,' whereas in all the examples under discussion the grooves are most marked and easily seen if looked at laterally without a lens. I certainly consider this very distinct form deserves a name, judging from the fact that all the half-grown to adult specimens in this collection from Port Alfred have this feature. I am giving it the subspecific name of *alfredensis*. Quoy and Gaimard, in the original description, make no mention of ribs or pits in the pleural areas, neither do they figure such. I would therefore indicate that *C. tulipa* s.s. is the smooth ungrooved form."

"The more perfect girdle scales in my holotype are translucent, highly polished, and closely, minutely striate, the apices minutely pitted under 65 mag.; they are also much bent over. The inside is bluish, translucent, insertion plate thick and pectinate, anterior valve 8 slits, median valve 1/1, tail valve 11, sutural laminae large, sinus between medium and the laminae joined across by a series of 10 or more blunt denticles; in the median valves the articulamentum is much thickened at the edge of the lateral areas, and the thickened eaves perforated by a series of holes which are most likely nerve-fibre channels." Angle of divergence, 93°. This last paragraph will equally apply to *C. tulipa* s.s. In conclusion: As far as I can determine, all or nearly all the Port Alfred examples in the various collections assembled before me belong to the subspecies *alfredensis*, but I have seen a specimen said to come from Camps Bay (west side of Cape Peninsula) which exhibits similar grooving and ribbing; therefore it looks likely that *alfredensis* is not a true geographic race but one of two distinct forms that exist side by side: future work must decide this.

Chiton crawfordi Sykes.

(Pl. VI, figs. 70-73.)

C. crawfordi, Sykes, Proc. Mal. Soc. Lond., iii, p. 279, 1899; *Ischnochiton* (in error) *crawfordi*, Ashby, loc. cit., p. 90, 1928.

General Appearance.—Elliptical, carinated, slightly beaked, lateral areas much raised; the whole shell is smooth except for a series of pits and grooves in the pleural area, where it abuts on the lateral,

which commence near the jugum as small pits and increase rapidly in size till, as the girdle is approached, they traverse the whole of this area; girdle broad, clothed with rather large imbricating scales; colour and pattern are variable, in shades of pink, olive, and dark brown.

Head Valve.—Broad and elevated, minutely decussate all over, possessing several distinct but shallow concentric growth grooves.

Median Valve.—Much elevated and carinated, side slope steep but slightly convex, dorsal area and upper portion of pleural minutely decussate; the only striking feature is the existence of a series of pits and grooves in the pleural area, commencing near the jugum as small pits and rapidly increasing in size until they form deep and broad grooves, traversing longitudinally the whole of the area. I count 6 of these latter, separated from each other by very broad and strong ribs; from these to the jugum are 8 pits and gashes, making a total of 14 in all; narrow transverse growth grooves cross the smooth portion of the dorsal-pleural area. Lateral area strongly raised and without sculpture except the minute decussation.

Tail Valve.—Unfortunately this valve in the disarticulated example is an abnormality, being a combination of parts of both 7th and 8th valves; mucro about central, posterior slope concave, anterior portion similar to pleural areas, and posterior similar to lateral areas, strongly raised separating rib.

Inside (articulamentum).—White, teeth serrate, eaves do not overhang, insertion plate extends beyond the eaves; head valve 8 slits, median valve 1/1, tail valve, Sykes gives 9 slits. The sutural laminae are shallow, laterally broad, jugal sinus narrow; a strongly serrate spade-like process connects across the sinus except for a bilateral slit.

Girdle.—Clothed with rather large, polished, imbricating scales, the exposed portion shuttle shaped, and grooved with shallow, closely packed striae; actually the scales are bent double, the exposed half imbricating.

Measurements.—Three examples have been sent to me from the Natal Museum, and a single median valve from the Oxford Museum, this latter collection by Col. Turton at Port Alfred. Whole shells, 26×14 mm., 19×9.5 mm., and 18×10 mm. respectively; head valve, 8×4.5 mm.; median valve, 10×6 mm.; tail valve (abnormal), 9×7 mm.; angle of divergence, 90° .

Habitat.—Port Shepstone; Port Alfred. Sykes gives Algoa Bay as locality of his type.

Chiton barnardi n. sp.

(Pl. VI, figs. 74-76 ; Pl. VII, fig. 77.)

Introduction.—There are two examples in the collection from the South African Museum of a very striking and hitherto undescribed *Chiton* which I have pleasure in naming after the discoverer Dr. K. H. Barnard. These are numbered respectively A6590, A5331 ; both were collected at the Island of Mozambique ; as the latter is in better preservation and retains its colour I am making it the holotype and disarticulating the paratype.

General Appearance.—Holotype curled, shell much elevated, slightly carinated, side slope steep and convex, end valves and lateral areas decorated with strong, subnodulose ribs, dorsal area smooth on most valves, and pleural area deeply and broadly longitudinally grooved ; girdle clothed with imbricating scales. Colour of holotype ochraceous salmon (Ridgway, pl. xv), girdle same colour, banded with white, the sides of the tail valve blotched with brown. Paratype—the colour of this specimen has faded, but shows a broad, pale, dorsal band on all valves after the second, with brown pleural areas.

Head Valve.—Strongly raised, anterior slope steep, convex, decorated with 10 broad, strongly raised, rounded ribs, which are in places shallowly, transversely ridged, and subgranulose at the side.

Median Valve.—Subcarinated and highly arched, side slope steep, convex, dorsal area defined, broadly wedge shaped and smooth. Pleural area possesses 9 deep, longitudinal grooves, all except the four nearest the dorsal ridge practically cross the area, although stopping just before actually reaching the anterior margin. Lateral area—this area is narrow and composed of 2 strongly raised, broad, subnodulose, rounded ribs.

Tail Valve.—Dorsal area smooth, except that, in common with some of the median valves of holotype, the first pair of longitudinal grooves are bowed upwards across the dorsal area, otherwise the anterior sculpture is similar to that of the pleural areas. The whole valve is truncated at the mucro, the posterior margin of valve is immediately beneath the mucro (which is in centre of valve), so that a vertical line would cut both the shell margin and the mucro. The posterior portion of valve is convex, decorated with 8 very strong radiating ribs ; these in the holotype number 10 and are sub-obsolete nodulose. This difference is still more apparent in the head valve, for in the holotype the lateral nodules on the ribs in that valve almost bridge across the intervening sulcus.

Inside.—Greyish white, translucent, polished; eaves barely overhang, spongy; teeth thick with bluntly serrate edge, grooved outside, smooth inside; anterior valve, slits 9; median valve, slits 1/1; tail valve, slits 13 (one of which seems an interpolation and a true slit); teeth very irregular and in the centre small, much grooved, dentate, and crowded; sutural laminae rather shallow, jugal sinus medium, narrowly joined across the median line, edge in sinus minutely serrate.

Girdle.—Clothed with large, imbricating scales, the grooving or fluting on the scales is easily detected under 20 mag., a short spiculose girdle-fringe is present on holotype. Detached scales measure $150 \times 90 \mu$, are translucent and deeply grooved with 7–8 grooves.

Measurements.—Whole shells too curled to measure; anterior valve (No. 4), 2.5×2.75 mm.; median valve, 4.5×2.5 mm.; tail valve, 2.5×2.75 mm. Angle of divergence, 80° .

Habitat.—Mozambique Island.

In conclusion.—The spongy eaves, the serrate extension of the articulamentum across the jugal sinus, and the peculiar truncated tail valve suggest possible justification for subgeneric separation, but for reasons I have advanced under the heading “Subgeneric Discussion” I leave it under the genus *Chiton*.

Subgenus *Sypharochiton* Thiele.

Sypharochiton, Thiele, Das Gebiss der Schnecken, ii, p. 365, 1893; type of subgenus *Chiton pellis-serpentis* Quoy and Gaimard.

Chiton (*Sypharochiton*) *nigrovirens* Blainville.

(Pl. VII, figs. 78–81.)

Chiton nigrovirens, Blainville, Dict. Sci. Nat., xxxvi, p. 538, 1825; Haddon, Challenger, Polyplac., p. 22, 1886. *C. capensis*, Gray, Spic. Zool., p. 5, 1828; Hanley, in Wood, Index Test. Suppl., i, fig. 11; Reeve, Conch. Icon., xxii, fig. 151; Krauss, Die Südafrik. Moll., p. 37. *C. nigrovirens*, Sowerby, Cat. S. Afr. Mollusca, 1892. *C. nigrovirens*, Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 132, 1894. *C. (Sypharochiton) nigrovirens*, Ashby, loc. cit., pp. 91, 93, pl. vii, fig. 17; Thiele in Schultze, Forsch. Reise, iv, p. 269, 1910.

General Appearance.—Elliptical, raised, arched, not carinated, strongly beaked; end valves and lateral areas decorated with shallow

ray-riblets; dorsal-pleural area indistinctly, longitudinally grooved; colour black, girdle banded; most other examples are grey and badly eroded; girdle clothed with large, solid, opaque, imbricating scales.

Head Valve.—Raised, rather large, laterally wide, decorated with about 30 closely packed, radial riblets, which are subgranulose; the whole surface of shell is minutely decussate.

Median Valve.—Arched, not carinated, side slope flat and convex; the dorsal-pleural area longitudinally but feebly grooved, the portion towards the jugum almost smooth; lateral areas raised and decorated with about 6 radial, granulose riblets.

Tail Valve.—Large, mucro anterior, defined; posterior slope steep; posterior portion double the size of the anterior, due largely to the lateral expansion of the shell; anterior portion unsculptured except for narrow growth grooves and minute granulation; posterior portion similar to the head valve.

Inside (articulamentum).—Bluish grey, except insertion plates and sutural laminae, which are dirty white; eaves spongy, insertion plate well produced. Head valve—slits 12, narrow and deeply cut; teeth irregular and sharply serrate; tegmentum narrowly infolded at the apex. Median valve—slits 1/1, serrate; sutural laminae shallow, jugal sinus very broad, and articulamentum extending one-third across on either side. Tail valve—slits 15; teeth uneven, very serrate; articulamentum shallowly joined across, edge bluntly dentate.

Girdle.—Clothed with large, solid, dull, opaque, imbricating scales without striae.

Measurements.—Whole shell (photo), 14×8.5 mm.; head valve, 7×3 mm.; median valve, 8.5×3 mm.; tail valve, 6×3.5 mm.; angle of divergence, 110° .

Habitat.—False Bay (S.A. Mus., A5337), Table Bay; one example (S.A. Mus., No. A5338) from Lüderitzbucht, S.-W. Africa; Port Alfred; Lüderitzbucht (Thiele).

Juvenile.—From the Turton Coll. (U.S. Nat. Mus., No. 125380) comes a juvenile example showing absence of sculpture except for microscopic granulation and growth lines.*

* Note by K. H. Barnard. Thiele (*loc. cit.*, 1910) refers to the presence of young under the mantle (girdle) edge. The same fact was observed in the case of the specimens collected by me at Smitswinkel Bay, False Bay, in July 1912. The young are about 75 mm. in length.

Subfamily LIOLOPHURINAE Pilsbry.

Subfamily *Liolophurinae*, Pilsbry, Man. Conch., xiv, p. 232, 1892.

Pilsbry's diagnosis must be enlarged and made to correspond with subfamily *Acanthopleurinae*, Thiele (*loc. cit.*, p. 117, 1909).

Note.—It must be admitted that the restricted genus *Liolophura* is not as typical as is the genus *Acanthopleura* of the group assembled by Thiele (and quite rightly so, I think), under his subfamily *Acanthopleurinae*; but under the International Rules of Nomenclature we are compelled to accept the earlier name.

Acanthopleura brevispinosa (Sowerby).

(Pl. VII, fig. 82.)

Chiton brevispinosa, Sowerby, Mag. Nat. Hist., p. 287, pl. xvi, fig. 1, 1840; Conch., iii, fig. 136; Reeve, Conch. Icon., fig. 52; *Acanthopleura brevispinosa*, Rochbrune, Nouv. Arch. du Mus., p. 240, 1881; *A. afra*, Rochbrune, Bull. Soc. Philom., p. 192, 1881-2; *A. quatrefagei*, Rochbrune, *loc. cit.*, p. 117, 1880-1; Journ. de Conch., p. 44, 1881; Ashby, *loc. cit.*, p. 91, 1928; *A. spinigera*, Odhner, Arkiv. Zool. Band., ii, No. 6, p. 21, 1919.

Note.—Pilsbry placed this species under his subgenus *Amphitomura*, of which *A. borbonica* Des. is the type species. I find a close resemblance between the various forms of *Acanthopleura* found on the coasts of the Indian Ocean, and think it quite possible that a careful investigation might necessitate considering most, if not all, as geographical races, i.e. subspecies of *Chiton gemmatus* Blainville (Dict. Sci. Nat., xxxvi, p. 544, 1825). At least the fairly extensive material in my own collection points to the futility of generically separating up the members of this group on the definitions supplied by various workers.

General Appearance.—Broad, subcarinated, beaked, shell much eroded, sculpture consisting of coarse, broken, wavy, irregularly granulose, more or less concentric riblets. Girdle very broad, beset thickly with short, stout, blunt calcareous spicules, with numberless much shorter spicules thickly intermingled. The end valves and the lateral areas are furnished with "eyes"; the example is not disarticulated; colour brown, with a dark dorsal stripe margined by a pale band.

Head Valve.—Very large, flat, upper half eroded, outer half decorated with wavy, concentric rows of granulose riblets, changing

in parts into disconnected grains; numerous "eyes" are present, mostly in the grooves.

Median Valve.—Valve 2 measures longitudinally half as much again as the others, subcarinated, beaked, upper third eroded, central portion decorated with widely spaced, irregular granules, which become much larger towards the girdle and are there arranged concentrically; "eyes" most numerous near the girdle.

Tail Valve.—Badly eroded, micro at posterior third, sculptured with granules arranged concentrically; eyes quite numerous on the non-eroded portion.

Inside.—Pilsbry gives "anterior valve 7-8, central 1, posterior 2, slits, and a number of irregular serrations; anterior teeth moderately long, finely pectinated outside; posterior teeth very short, blunt, obsoletely pectinated."

Girdle.—Densely clothed with coarse, blunt, short, calcareous spicules, the interspaces crowded with very short almost pebble-like spicules.

Measurement.—Dry, much curled, 25×21 mm. Angle of divergence, 130° (Pilsbry).

Habitat.—Mozambique Island (S.A. Mus., No. A5330).

Onithochiton literatus (Krauss).

(Pl. VII, figs. 83-86.)

Chiton literatus, Krauss, Die Südafrik. Moll., p. 36, pl. iii, fig. 6; *C. wahlbergi*, Krauss, Die Südafrik. Moll., p. 36, pl. iii, fig. 1; *Onithochiton literatus*, Pilsbry, Man. Conch., xiv, p. 251, pl. lv, figs. 22-23, 1892; *Plaxiphora wahlbergi*, Pilsbry, loc. cit., p. 322, pl. lv, figs. 17-18, 1892; *Onithochiton literatus* and *O. wahlbergi*, Thiele? same species, Rev. Syst. der Chit., p. 98, 1909; Ashby, loc. cit., p. 91, note 92, 1928; *O. lyalli*, Odhner (non-Sowerby), Faun. Malac. de Madagascar, p. 40, 1919; Arkiv. Zool., B. 12, No. 6.

Introduction.—It will be seen from the above synonymy that I consider *C. literatus* and *C. wahlbergi*, both of Krauss, as conspecific. Pilsbry considered *C. wahlbergi* as belonging to the genus *Plaxiphora*, treating it as the only representative of a distinct group. I noticed that Krauss' figure of the whole shell, in both proportion and shape, is that of a typical *Onithochiton* and not that of a *Plaxiphora*; the insertion plate and head valve, as shown in his figures, are characteristic of the genus *Onithochiton* and not of that of *Plaxiphora*, and in addition Krauss states "girdle brown, leathery, velvety," a descrip-

tion that could not apply to the strongly spiculose girdle of the genus *Plaxiphora*.

Krauss, immediately under his figure of *C. wahlbergi*, figures another *Onithochiton*, which is not eroded as is the first figure; this he calls *C. literatus*. In this figure the shape of the valves is similar to that of *C. wahlbergi*, except that the tail valve is a little pointed, whereas *wahlbergi* is blunt, due no doubt to erosion. I consider these conspecific, for the following reasons: (a) It is unlikely that two distinct species of the restricted genus *Onithochiton* will be living together; (b) the amount of variation revealed in Krauss' figures and descriptions and in the series of examples now before me is no more than is common in the species found along the Western Australian coast from Shark Bay in the north to the Leeuwin in the south, and called *Onithochiton quercinus occidentalis* Ashby. Since writing the foregoing notes I have read a translation of Thiele's work of 1910, in which he states that he had come to the same conclusion.

General Appearance.—Animal elongate, sides parallel, not wider in the middle as in most Chitons, shell arched, strong, broken, growth grooves around outer margin of all valves; sculpture of dorsal-pleural area covered with numerous, deep, longitudinal, and diagonal grooves. These grooves in the lateral areas are broken and irregular; the ground colour is dark and the sculpture several shades of lighter brown. "Eyes," with a grey cornea 36μ in diameter, are so scattered over the head valve, on the outer margin only in the tail valve, and in the lateral area of the median valves.

Head Valve.—The sculpture of two-thirds of the non-eroded portion of the example under examination consists of a series of large irregular and very angular, flattened grains, which in the main follow the concentric grooves. These, almost blocks of flattened sculpture, are in places joined across the concentric growth grooves; those furthest from the girdle are still more irregular and vermiform; "eyes" are scattered over this valve.

Median Valve.—The shell is very flat, the dorsal-pleural area is decorated with numerous flat-topped, diagonal riblets, converging anteriorly. These ribs are separated by deep grooves, which are less than half the width of the riblets; these are broken where crossed by growth grooves; the lateral areas are crossed by a series of large, irregular grains, which are more circular than in the head valve, the grains follow deep, concentric growth grooves; "eyes" present on anterior half of this area.

Tail Valve.—Very flat, mucro undoubtedly posterior but eroded,

anterior portion similar to dorsal-pleural area, valve bent over laterally; posterior portion very narrow, growth grooves follow contour of margin and converge at the mucro; numerous "eyes" present.

Inside (articulamentum).—White. Anterior valve—insertion plate well produced, slits 8, teeth regular, closely and deeply grooved on outside, smooth inside, edge of teeth finely serrate, eaves shallow. Median valve—slits 1/1, very broad, edge of teeth numerously grooved, sutural laminae strongly produced forward, jugal sinus wide, laminae joined across the middle line by an extension of the articulamentum, which is deeply serrate. Tail valve—insertion plate obsolete, the articulamentum ending in a callus, eaves much overhung.

Girdle.—Under pocket lens brown and felty, but under 65 mag. seen to be densely covered with short, stout, rather blunt spicules; one measured was $125 \times 25 \mu$.

Measurements.—Whole shell, dried and curled, 20×12 mm.; head valve, 7.5×4.5 mm.; median valve, 10×6 mm.; tail valve, 8×4.5 mm.; angle of divergence, 105° .

Habitat.—Scottburgh; Port Shepstone; Umkomaas; Port St. Johns; Durban Bay.

Note.—Since the descriptions were written and figures made I have received from the Natal Museum several uncurled examples of this shell. One almost perfect example, measuring 35×20 mm., is broadly banded down the centre with bright chestnut, and beautifully mottled on either side with cream markings arranged in a sort of scalloped pattern. The sculpture differs little from the foregoing description. Some examples have but little sculpture left, except the deep growth grooves that follow the outer margin; in others these grooves are almost absent, and most of the valves are covered with the irregular grooved and ribbed sculpture described herein. I am grateful to Dr. E. Warren, Director of the Natal Museum, for so kindly sending along these specimens, for they fully confirm the conclusion already come to that *C. wahlbergi* and *C. literatus* are conspecific. The latter name has line precedence.

Chitons which have been incorrectly credited to the South African Fauna or about which there is grave doubt.

Acanthochiton spiculosus Reeve.—Sykes states this was recorded from Port Elizabeth by Sowerby, in error; it is a West Indian species.

Plaxiphora carmichaelis Gray, 1828.—Sykes considers this conspecific with *Chiton setiger* King, 1831, and therefore Gray's name antedates that of King. It is a South American species.

Ischnochiton cyaneopunctatus, Krauss, Die Südafrik. Moll., p. 40, pl. iii., fig. 2, 1848. Krauss' figure and description fit perfectly with *Ischnochiton lentiginosus*, Sowerby, Mag. Nat. Hist., iv, p. 293, 1840. A common shell in New South Wales, Australia. It is evident that through error Krauss described an Australian species in mistake for a South African one. That South Africa does possess a blue spotted *Ischnochiton* I have shown in my description of *I. delagoensis*; but this species belongs to a group of the genus *Ischnochiton*, entirely different from the species described and figured by Krauss, and is only known up to the present by the unique example described herein. It is, however, quite possible that *delagoensis* extends down along the Zululand and Natal coast.

Ischnochiton pruinosus Gould, 1846, is a South American shell incorrectly recorded as from South Africa by Sowerby under the name of *Chiton pruinosus*.

Acanthopleura afra, Rochebrune, 1881, and *A. quatrefagesi*, Rochebrune, 1882, have both been recorded as from the Cape of Good Hope and Madagascar. Pilsbry included them in his list of "Insufficiently described Chitons," and Sykes expressed grave doubts as to the correctness of the localities given. I have included both as synonyms of *Acanthopleura brevispinosa* Sowerby.

Extra-limital Chitons.

I am not clear as to what the recognised boundaries are of the Faunal Region of South Africa, but I assume that Madagascar is not included; but as it is likely that there may be species common to both sides of the Mozambique Channel I give below names of those species listed or described by Dr. Nils Hj. Odhner in his paper on "Faune Malacologique de Madagascar, 1919."

Acanthochiton aberrans, Odhner, p. 22, Majunga; *A. penicillatus*, Deshayes, p. 40, Tamatave; *Choneplax indicus*, Deshayes, p. 40, Tamatave; *Ischnochiton rufopunctatus*, Odhner, p. 21, Majunga; *Acanthopleura spinigera*, Sowerby, p. 21, Majunga. This I have queried (*supra*) as being *A. brevispinosa* (Sowerby), but have pointed out that this, as well as *A. spinigera* Sow., are probably subspecies of *A. gemmatus* Blainville, 1825. *Onithochiton lyellii*, Sowerby, p. 40, Tamatave—this record I have placed under *O. literatus* (Krauss).

CHECK LIST OF SOUTH AFRICAN CHITONS.

CLASS AMPHINEURA.

ORDER POLYPLACOPHORA (Blainville emend.) Gray, 1821.

(PRIMITIVE.)

SUBORDER EOPLACOPHORA Pilsbry, 1900. (Palaeozoic only.)

Family GRYPHOCHITONIDAE Pilsbry, 1900. (Palaeozoic only.)

SUBORDER PROTOCHITONINA Ashby, 1928.

Family PROTOCHITONIDAE Ashby, 1925. (Fossil only.)

Family ACANTHOCHITONIDAE Hedley, 1916.

Subfamily AFOSSOCHITONINAE Ashby, 1925. (Fossil only.)

(ADVANCED.)

Subfamily ACANTHOCHITONINAE Ashby, 1925.

Genus *Acanthochiton* Gray emend., 1821.*Acanthochiton garnoti* (Blainville), 1825.*Acanthochiton turtoni* Ashby, 1928.*Acanthochiton turtoni* var. *tenuigranulosus* Ashby.Genus *Notoplax* H. Adams, 1861.*Notoplax productus* (Pilsbry), 1892.

Subfamily CRYPTOPLACINAE Thiele, 1909.

Genus *Cryptoplax* Blainville, 1918.*Cryptoplax sykesi* Thiele, 1909.*Cryptoplax dupuisi* Ashby (Madagascar).

(PRIMITIVE.)

SUBORDER LEPIDOPLEURINA Thiele, 1909.

Family LEPIDOPLEURIDAE Pilsbry, 1892.

Genus *Lepidopleurus* Risso, 1826.*Lepidopleurus sykesi* (Sowerby), 1903.

(ADVANCED.)

SUBORDER CHITONINA Thiele, 1909.

Family CALLOCHITONIDAE Thiele, 1909.

Subfamily TRACHYDERMONINAE Thiele, 1909.

Genus *Trachydermon* Carpenter, 1863.Subgenus *Craspedochilus* Sars, 1878.*Trachydermon* (*Craspedochilus*) *turtoni* Ashby, 1928.

Subfamily CALLOCHITONINAE Thiele, 1909.

Genus *Callochiton* Gray, 1847.Subgenus *Trachyradsia* Dall, 1878.*Callochiton* (*Trachyradsia*) *castaneus* (Wood), 1815.

Family MOPALIDAE Pilsbry, 1892.

Genus *Plaxiphora* Gray, 1847.

- Plaxiphora simplex* Haddon (Tristan da Cunha).
 Family ISCHNOCHITONIDAE Pilsbry, 1892.
 Subfamily CHAETOPLEURINAE Thiele, 1909.
 Genus *Chaetopleura* Shuttleworth, 1853.
Chaetopleura papilio (Spengler), 1797.
Chaetopleura pertusus (Reeve), 1847.
Chaetopleura destituta Sykes, 1902.
 Genus *Dinoplax* Dall, 1882.
Dinoplax gigas (Gmelin), 1788.
 Subfamily ISCHNOCHITONINAE Pilsbry, 1892.
 Genus *Ischnochiton* Gray, 1847.
Ischnochiton oniscus (Krauss), 1848.
Ischnochiton oniscus alfredensis Ashby.
Ischnochiton elizabethensis Pilsbry, 1894.
Ischnochiton hewitti Ashby.
Ischnochiton ludwigi (Krauss MSS.) Pilsbry, 1892.
 Subgenus *Radsia* Pilsbry, 1892.
Ischnochiton (Radsia) textilis (Gray), 1828.
Ischnochiton (Radsia) tigrinus (Krauss), 1848.
Ischnochiton (Radsia) delagoensis Ashby.
 Family CHITONIDAE Pilsbry, 1892.
 Subfamily CHITONINAE Pilsbry, 1892.
 Genus *Chiton* Linne, 1758.
 Subgenera *Clathropleura*, *Rhyssoplax*, and *Anthochiton* (not used).
Chiton tulipa Quoy and Gaimard, 1834.
Chiton tulipa alfredensis Ashby, 1928.
Chiton crawfordi Sykes, 1899.
Chiton barnardi Ashby.
 Subgenus *Sypharochiton* Thiele, 1893.
Chiton (Sypharochiton) nigrovirens Blainville, 1825.
 Subfamily LIOLOPHURINAE Pilsbry, 1892.
 =ACANTHOPLEURINAE Thiele, 1909.
 Genus *Acanthopleura* Guilding, 1829.
Acanthopleura brevispinosa (Sowerby), 1840.
 Genus *Onithochiton* Gray, 1847.
Onithochiton literatus (Krauss), 1848.
 =*O. wahlbergi* Krauss, 1848.

EXPLANATION OF TEXT-FIGURES 1 AND 2.

FIG. 1. Composite diagram of a Chiton to illustrate terminology. Parts of the shell: A, Head valve; B, Six median valves; C, Tail valve; D, Girdle; E, Dorsal area; F, Pleural area; G, Lateral area; H, Mucro. Sculpture: I, Radial ribbing; J, Longitudinal ribbing; K, Granulose; L, Radial granulose ribbing; M, Radial bifurcating ribbing; N, Scales (smooth or striate); O, Tufts of spicules or hair tufts; P, Calcareous spines; Q, Girdle-fringe. (Adapted from Iredale and Hull, 1923.)

FIG. 2. *Cryptoplax sykesi* Thiele: a, whole animal; b, head valve; c, seventh valve; d, eighth valve. (From Sykes.)

EXPLANATION OF PLATES.

PLATE I.

FIG.

1. *Acanthochiton garnoti* (Blainville). Cape. Whole shell. Ashby Coll. $\times 4$.
2. *Acanthochiton garnoti* (Blainville). Cape. Head valve, showing broad insertion plate with 5 slits. Ashby Coll. $\times 6\frac{1}{2}$.
3. *Acanthochiton garnoti* (Blainville). Same example as No. 2. Median valve. $\times 6\frac{1}{2}$.
4. *Acanthochiton garnoti* (Blainville). Same example as No. 2. Tail valve, having 2 slits only. $\times 6\frac{1}{2}$.
5. *Acanthochiton turtoni* Ashby. Port Alfred. Holotype. Whole shell. Oxford Mus. $\times 6\frac{1}{2}$.
9. *Notoplax productus* (Pilsbry). Jeffrey's Bay. Whole shell curled, showing great width of girdle. Trans. Mus., No. 759. \times about $5\frac{1}{2}$.
10. *Notoplax productus* (Pilsbry). Same example as No. 9. Head valve. $\times 5\frac{1}{2}$.
11. *Notoplax productus* (Pilsbry). Same example as No. 9. Median valve, insertion plate broken, slit inconspicuous. $\times 5\frac{1}{2}$.
12. *Notoplax productus* (Pilsbry). Same example as No. 9. Tail valve, showing very broad slits. $\times 5\frac{1}{2}$.

PLATE II.

6. *Acanthochiton turtoni* Ashby. Holotype. Same example as No. 5. Holotype. Head valve, incomplete insertion plate. $\times 7$.
7. *Acanthochiton turtoni* Ashby. Holotype. Same example as No. 5. Median valve. $\times 7$.
8. *Acanthochiton turtoni* Ashby. Holotype. Same example as No. 5. Tail valve. $\times 7$.
13. *Acanthochiton turtoni* var. *tenuigranulosus* nov. Port Alfred. Holotype of variety. Ashby Coll. $\times 5$.
14. *Cryptoplax dupuisi* n. sp. Madagascar. Holotype. (Straightened out for photo.) Whole shell, showing small, widely spaced valves. Ashby Coll. $\times \frac{1}{3}$.
15. *Cryptoplax dupuisi* n. sp. Madagascar. Holotype. Same example as No. 14. $\times 2\frac{1}{2}$.
16. *Lepidopleurus sykesi* (Sowerby). Dredged off Cape Point. Whole shell, much curled. S.A. Mus., No. A5343. $\times 4\frac{1}{2}$.
17. *Lepidopleurus sykesi* (Sowerby). Same example as No. 16. Head valve. $\times 6$.
18. *Lepidopleurus sykesi* (Sowerby). Same example as No. 16. Median valve, showing weak sutural laminae. $\times 6$.
19. *Lepidopleurus sykesi* (Sowerby). Same example as No. 16. Tail valve. $\times 6$.
20. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Port Alfred. Holotype. Whole shell. Oxford Mus. $\times 7$.
21. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Holotype. Same example as No. 20. Head valve. $\times 7$.
22. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Holotype. Same example as No. 20. Median valve. $\times 7$.
23. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Holotype. Same example as No. 20. Tail valve. $\times 7$.
24. *Callochiton* (*Trachyradsia*) *castaneus* (Wood). Table Bay. S.A. Mus., No. 4872. Whole shell. $\times 5$.

PLATE III.

FIG.

25. *Callochiton (Trachygradsia) castaneus* (Wood). Port Alfred. (Trans. Mus., No. 754, now Ashby Coll.). Head valve. $\times 6$.
26. *Callochiton (Trachygradsia) castaneus* (Wood). Same example as No. 25. Median valve. $\times 6$.
27. *Callochiton (Trachygradsia) castaneus* (Wood). Same example as No. 25. Tail valve. $\times 6$.
28. *Plaxiphora simplex* Haddon. Tristan da Cunha. Part of girdle. $\times 4$.
29. *Plaxiphora simplex* Haddon. Same example as No. 28. Head valve. $\times 4$.
30. *Plaxiphora simplex* Haddon. Same example as No. 28. Median valve. $\times 4$.
31. *Plaxiphora simplex* Haddon. Same example as No. 28. Tail valve. $\times 4$.
32. *Chaetopleura papilio* (Spengler). Kalk Bay. S.A. Mus., No. 4887. Median valve. Note spade-like process in jugal sinus. $\times 4$.
33. *Chaetopleura papilio* (Spengler). Same example as No. 32. Tail valve. $\times 4$.
34. *Chaetopleura pertusus* (Reeve). False Bay. S.A. Mus., No. 6766. Head valve. $\times 5$.
35. *Chaetopleura pertusus* (Reeve). Same example as No. 34. Median valve. $\times 5$.
36. *Chaetopleura pertusus* (Reeve). Same example as No. 34. Tail valve. $\times 5$.

PLATE IV.

37. *Chaetopleura destituta* Sykes. S.A. Mus., No. 4880. Whole shell, about natural size, girdle expanded a little for photo.
38. *Chaetopleura destituta* Sykes. S.A. Mus., No. 4874. Half median valve. $\times 4$.
39. *Chaetopleura destituta* Sykes. Same example as No. 38. Tail valve. $\times 4$.
40. *Dinoplax gigas* (Gmelin). Port Alfred. Head valve. Ashby Coll. $\times 4$.
41. *Dinoplax gigas* (Gmelin). Same example as No. 40. Median valve. $\times 4$.
42. *Dinoplax gigas* (Gmelin). Same example as No. 40. Tail valve. $\times 4$.
43. *Ischnochiton oniscus* (Krauss). Port Shepstone. Whole shell. Natal Mus. $\times 4\frac{1}{2}$.
44. *Ischnochiton oniscus* (Krauss). Port Alfred. Head valve. Ashby Coll. $\times 4$.
45. *Ischnochiton oniscus* (Krauss). Same example as No. 44. Median valve. $\times 4$.
46. *Ischnochiton oniscus* (Krauss). Same example as No. 44. Tail valve. $\times 4$.
47. *Ischnochiton elizabethensis* Pilsbry. Port Alfred. Head valve. Ashby Coll. $\times 7$.
48. *Ischnochiton elizabethensis* Pilsbry. Same example as No. 47. Median valve. $\times 7$.
49. *Ischnochiton elizabethensis* Pilsbry. Same example as No. 47. Tail valve. $\times 7$.

PLATE V.

50. *Ischnochiton hewitti* n. sp. Table Bay. Holotype. Whole shell. Albany Mus., No. 8085. $\times 4\frac{1}{3}$.
51. *Ischnochiton hewitti* n. sp. Same example as No. 50. Holotype. Head valve. $\times 5\frac{2}{3}$.
52. *Ischnochiton hewitti* n. sp. Same example as No. 50. Holotype. Median valve. $\times 5\frac{2}{3}$.

FIG.

53. *Ischnochiton hewitti* n. sp. Same example as No. 50. Holotype. Tail valve. $\times 5\frac{2}{3}$.
54. *Ischnochiton oniscus alfredensis* n. subsp. Port Alfred. Holotype. Whole shell. Transvaal Mus. $\times 6$.
55. *Ischnochiton ludwigi* ? (Krauss MSS.) Pilsbry. ? Table Bay. Albany Mus. Part of Mus. No. 5078. $\times 5$.
56. *Ischnochiton (Radsia) textilis* (Gray). Saldanha Bay. Head valve. S.A. Mus., No. A5340. $\times 5$.
57. *Ischnochiton (Radsia) textilis* (Gray). Same example as No. 56. Median valve. $\times 5$.
58. *Ischnochiton (Radsia) textilis* (Gray). Same example as No. 56. Tail valve. $\times 5$.
59. *Ischnochiton (Radsia) tigrinus* (Krauss). Port Elizabeth. Head valve. Ashby Coll. $\times 4\frac{1}{3}$.
60. *Ischnochiton (Radsia) tigrinus* (Krauss). Same example as No. 59. Median valve. $\times 4\frac{1}{3}$.
61. *Ischnochiton (Radsia) tigrinus* (Krauss). Same example as No. 59. Tail valve. $\times 4\frac{1}{3}$.
62. *Ischnochiton (Radsia) tigrinus* (Krauss). Same example as No. 59. Whole shell. $\times 4\frac{1}{3}$.

PLATE VI.

63. *Ischnochiton (Radsia) delagoensis* n. sp. Delagoa Bay. Holotype. Whole shell. S.A. Mus., No. A6589. $\times 7$.
64. *Ischnochiton (Radsia) delagoensis* n. sp. Same example as No. 63. Head valve, broken. $\times 6$.
65. *Ischnochiton (Radsia) delagoensis* n. sp. Same example as No. 63. Median valve. $\times 6$.
66. *Ischnochiton (Radsia) delagoensis* n. sp. Same example as No. 63. Tail valve. $\times 6$.
67. *Chiton tulipa alfredensis* Ashby. Port Alfred. Holotype. Head valve. $\times 4\frac{1}{2}$.
68. *Chiton tulipa alfredensis* Ashby. Same example as No. 67. Median valve, showing longitudinal pitting, which feature alone separates it from typical *C. tulipa*. $\times 4\frac{1}{2}$.
69. *Chiton tulipa alfredensis* Ashby. Same example as No. 67. Tail valve. $\times 4\frac{1}{2}$.
70. *Chiton crawfordi* Sykes. Port Shepstone. Whole shell. Natal Mus. $\times 5$.
71. *Chiton crawfordi* Sykes. Port Shepstone. Head valve. Another example. Natal Mus. $\times 4\frac{1}{2}$.
72. *Chiton crawfordi* Sykes. Same example as No. 71. Median valve. $\times 4\frac{1}{2}$.
73. *Chiton crawfordi* Sykes. Same example as No. 71. Tail valve and part of valve 7 have been welded together, making this example an abnormal seven-valved shell. $\times 4\frac{1}{2}$.
74. *Chiton barnardi* n. sp. Mozambique Is. Paratype. Head valve. S.A. Mus., No. A6590. \times nearly 6.
75. *Chiton barnardi* n. sp. Same example as No. 74. Median valve. \times nearly 6.
76. *Chiton barnardi* n. sp. Same example as No. 74. Tail valve. \times nearly 6.

PLATE VII.

FIG.

77. *Chiton barnardi* n. sp. Mozambique Is. Holotype. Whole shell, curled. S.A. Mus., No. A5331. $\times 7$.
78. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Cape. Whole shell. Ashby Coll. $\times 4\frac{1}{2}$.
79. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Same example as No. 78. Head valve, slightly damaged. \times nearly 5.
80. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Same example as No. 78. Median valve. \times nearly 5.
81. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Same example as No. 78. Tail valve. \times nearly 5.
82. *Acanthopleura brevispinosa* (Sowerby). Mozambique Island. S.A. Mus., No. A5330. Portion of photograph of whole shell, curled, showing the calcareous spines of the girdle. $\times 3\frac{1}{2}$.
83. *Onithochiton literatus* (Krauss). Port Shepstone. Whole shell much eroded, but showing concentric grooving of *C. wahlbergi* and longitudinal grooving of *C. literatus* of Krauss. S.A. Mus., No. A5332. $\times 2$.
84. *Onithochiton literatus* (Krauss). Another example from Port Shepstone. Head valve, showing serrate insertion plate. Ashby Coll. $\times 5$.
85. *Onithochiton literatus* (Krauss). Same as example No. 84. Median valve. $\times 5$.
86. *Onithochiton literatus* (Krauss). Same example as No. 84. Tail valve. $\times 5$.